

Bell's Agricultural Series

THE FARM  
AND  
THE DAIRY

*PROF. J. P. SHELDON*



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Bell's Agricultural Series.

*THE FARM AND THE DAIRY.*

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J. P. SHELDON.



# THE FARM AND THE DAIRY.

BY

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Illustrated.

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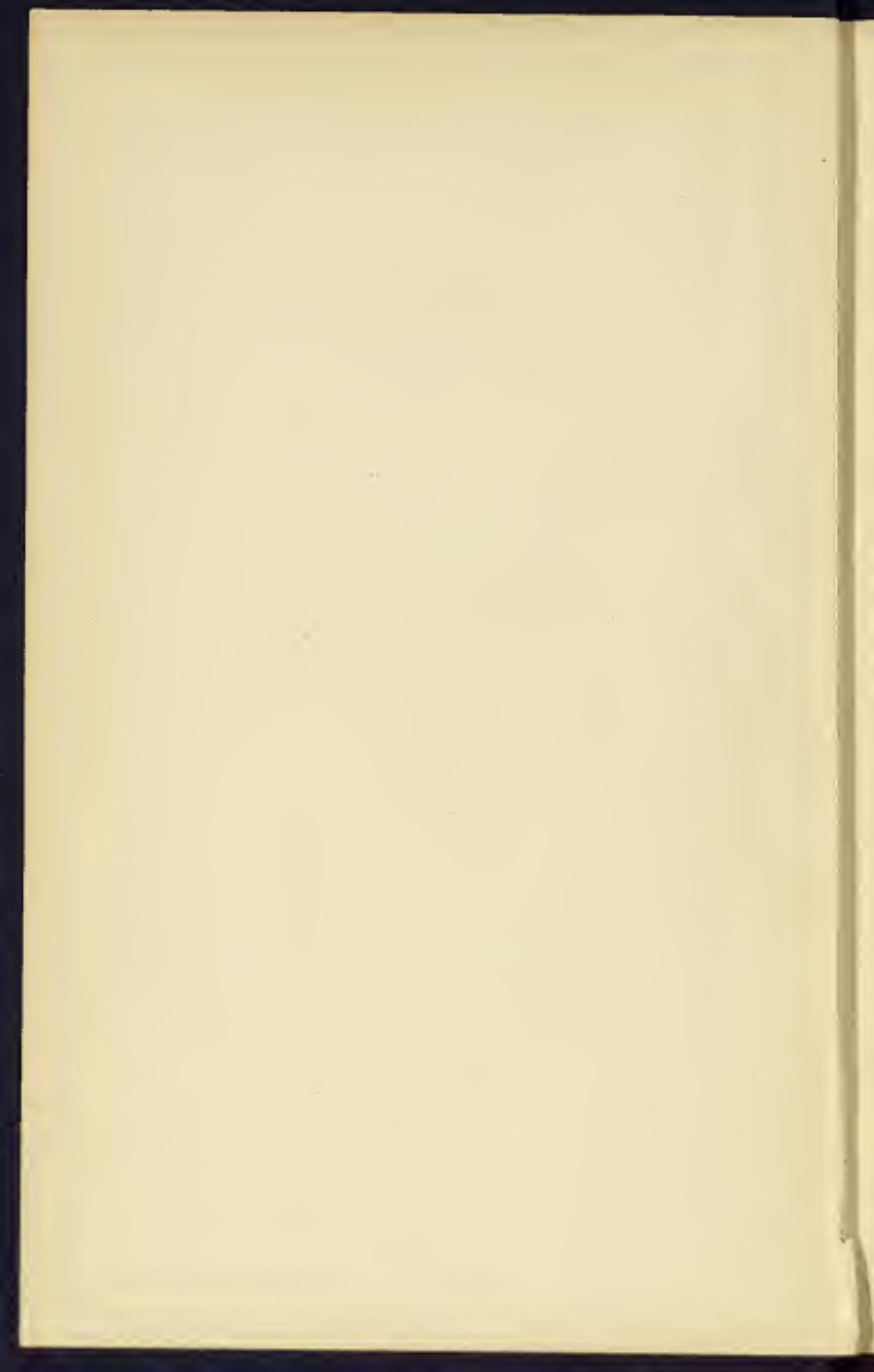
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## INTRODUCTION.

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THE modern developments in Dairy Farming, the new departures of which it has been proved to be capable, and the increasing attention which it commands, find no parallel in other branches of our national agriculture. It is, we may say, more varied and comprehensive than they are, with a wider range of duties and possibilities, employing more capital, and promising in the future to be even more important than it is in the present, or has been in the past. In many of its features we find a transformation since twenty years ago,—and who shall say the next twenty will not produce greater changes still? Public attention has been attracted to it in an uncommon degree, and the interest is growing. An influential Association, which is yearly becoming more important and popular, exists specially for its benefit, and the older and greater Agricultural Societies of the land are now according to it some of the importance which it properly claims.

These are the considerations on which it has been thought desirable to publish a handbook, whose object is to be of some service to farmers who pursue dairying as a business, to amateurs who indulge in it as a pleasure, and to students within and without our Colleges. The literature of the dairy in England is already considerable, including volumes by Morton, Roland, "Ruricola," Long, and others, besides various pam-

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phlets, essays, and reports, as well as papers in the *Journals* of our principal Agricultural Societies and Farmers' Clubs; and I too have aforetime contributed a somewhat comprehensive volume, which was published ten years ago by Messrs. Cassell, Petter, and Galpin. Some of these volumes are out of print; others too expensive for general demand, or too large for handy use; and it may be hoped that, while there is room for still other productions of the pen, a convenient volume, at the easy price of half-a-crown, will prove to be acceptable to many persons.

Herewith is given, as far as space has permitted, the substance of lectures delivered during the last ten years at the College of Agriculture, Downton. I desire in the preface to remind the public of the great and unique services rendered to British Dairy Farming by the late H. M. Jenkins, many years the able and indefatigable Secretary of the Royal Agricultural Society, whose lucid expositions of the dairy practices of several Continental countries have added so much to our knowledge of what other people are doing, and whose life-work ended far too early in the grave.

JOHN PRINCE SHELDON.

THE BRUND, SHEEN, ASHBOURN,  
1889.

## THE FARM AND THE DAIRY.

To begin, as I intend to do, with remarks about the farm, rather than about the stock it will carry, may possibly seem like "putting the cart before the horse,"—the inert before that which has volition. Well, let us examine the question before we decide upon it.

In the first place, a man must needs have a farm before he can put stock upon it. Therefore, the farm is one of his first considerations, and perhaps the most important one. Anyway, the sort of farm a man has will be found to have a good deal to do with his success or his failure, as the case may be. The quality, condition, and nature of the land,—its soundness, its fertility, its altitude, its climate, its aspect or slope, its form and situation, its natural or acquired shelter, its water supply, its buildings, fences, roads, its propinquity to markets and to a railway, and its rent, rates, and taxes,—these are the considerations that endow the farm with a measure of importance which demands most careful attention. The capital a man has, both in cash and in skill, in health and in energy, in experience and in application, is of course a factor of very considerable moment, and it will be unwisely invested in a farm that is unsuitable. And, again, unsound land, deficient in natural or applied fertility, with a northern or eastern slope, and exposed to the rigours of a vicious climate, will not maintain the size and quality and productiveness of a good class of stock, of any breed whatever, that may be placed upon it. We

may consider, therefore, that to speak of the farm first, is not very obviously to place the cart before the horse.

A farm of sound land,—that is, of land that has not needed artificial draining,—is, quality for quality, preferable to one that has been drained, providing the soil is not of too loose and unretentive a character. All the same, however, it is true that many drained farms are so healthy for stock, so productive, and so good in nearly every respect, that we must not omit them from our list of eminently desirable occupations. But a naturally dry farm, whose deep, strong loam is just sufficiently open in texture not to require draining, will carry the palm against any other sort, for dairying purposes. It is a question of subsoil rather than of surface, because artificial draining is hardly ever required save where the subsoil is a stiff, impervious clay, or where subterranean egress is impeded by a geological peculiarity. Water will of course percolate through any soil that has an agricultural value, and it is the presence or absence of natural means of escape through the subsoil which makes the difference between sound and unsound land. Where such means are naturally absent they must be artificially supplied, and this is the primary object, though not the end, of draining. The effect of draining a water-logged soil, is to improve its mechanical condition, to increase its temperature by the exclusion of superfluous wet, and the inclusion of air,—in fact, to establish circulation through it, and to lay it dry. Soils on rocky formations, on marl, or gravel, or sand, are generally sound, but it sometimes happens that such natural drainage is too thorough, in which event the surface soil, being of too loose a character, is not only liable to burn in summer, but is not sufficiently retentive either of moisture or of

applied manures,—especially of artificial manures, which pass too quickly through a loose, open soil.

The situation of a farm,—the altitude of it, the climate to which it is subject, the aspect, whether toward or away from the sun, and the shelter, whether natural or artificial, with which it is supplied,—is of greater moment than many men seem to be aware of. A farm unfavourably situated in these respects is more or less cold, and therefore detrimental for stock, and will not produce herbage so varied, and plentiful, and nutritious as will be found elsewhere. Shelter, indeed, apart from its influence on the quantity and quality of the herbage, is necessary to the comfort and the health of cattle, and so to their productiveness and profit. It stands, in fact, in the place of so much food; for if animals are exposed to storms and biting blasts of wind, of rain, and sleet, and snow, the digestion of an extra amount of food in their stomachs is required to maintain the temperature of their systems. An undulating surface provides what is called “land shelter,” and this is natural shelter, though seldom adequate to the object we have in view; and it may therefore very wisely be supplemented by plantations and fences, wherever they may be necessary. But “while the grass grows, the horse starves”; and when a man selects a dairy farm, it is expedient that the required shelter should be already present instead of merely potential.

A reliable supply of good water,—brooks and rivulets are generally the best, providing they are tolerably pure,—is indispensable on a dairy farm. Cows in milk drink a large quantity of water, and it is obvious that impure water cannot but be detrimental to the cows and to the milk they yield, notwithstanding the *vis medicatrix*

*naturæ*, which fortunately exists to counteract some of the ills the flesh is heir to. Stagnant water in ponds and meers is the common and only possible supply on many dairy farms, and, while it is generally inferior to that of running brooks, it is found to answer the purpose fairly well; it is inferior chiefly because of the impurities which find their way into it. It will be found worth while, by him who will be at the trouble, to supply cows in milk with chilled water, in the winter months, specially in frosty weather. Cattle of all sorts, in fact, unless they run loose and can drink when they like, would be benefited by having a water supply whose temperature does not fall below 55° to 50° Fahr.; and, indeed, the same may be said of horses in the stable, while it is well known that pigs fed on warm food will thrive better than others that are fed on cold, quality and quantity being equal.

The importance of good roads to and on a farm is best appreciated by him who has had to put up with bad ones. The loss of time, and the wear and tear of horses and vehicles that are caused by bad roads, must necessarily diminish the farmer's profits. The same may be said, indeed, of inferior buildings, badly arranged. A farm is most cheaply managed when it is compact in form, enclosed within a good ring fence to prevent straying and trespassing, has its house and buildings situated pretty nearly in the centre and well arranged, and is provided with good roads. The work of a farm is greatly facilitated by the presence of good roads here and there about it, and in busy seasons this is a convenience of considerable value. Main roads and parish highways are also a great convenience to a farm, when they are kept in good repair, because they lend facilities of approach to markets

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and to railway stations. Markets within easy distances are found to be very useful, and a railway station within two or three miles gives to a dairy farmer an additional string to his bow, in the shape of a milk trade, if he thinks well to take it in hand. And, indeed, the milk trade appears to be the chief hope of the future, as it is also the safeguard already of a large proportion of the dairy farmers of this country.

In respect of the capital needed to stock a dairy farm, a man must needs "cut his coat according to his cloth." Young men generally are better without unlimited capital, if they are to become frugal managers; yet some of them think they ought to begin where their fathers left off,—that is, when their fathers have been prosperous. When they do start this way, they seldom learn what their fathers learnt. If a young man can have his farm well equipped with live and dead stock, and a half-year's rent in the bank, with no expectations save the results of his own energy and skill, he will stand a good chance of winning success. I have known many who, as young men, started with about half the capital the farm really needed, and have worked their way into good positions, aided, of course, by competent wives; and I have known others whose careers, with better beginnings, had very different endings. All the same, however, in the evil days that have fallen upon us since 1878, there is not now the same chance of working one's way up as there was a short generation ago; and it therefore follows that a sufficient capital, say £10 to £12 per acre, is more necessary to success now than it formerly was. Everything of course, or nearly everything, depends on the training a young man has had, on the business habits he has acquired, and on his native common sense. It must be borne in mind that while the

wages of hired servants and the scale of tradesmen's bills are not likely to get any lower, the tendency of rates and taxes is still upwards. These items form, in fact, a second rent, which should always be considered when negotiating about the first. If the produce of a farm will gross three rents, the farmer may save money if he will; and to save money is, as I take it, the end and aim of tenant farmers. Farming for pleasure is a pastime in which fewer men engage now than was formerly the case, and for these there is no need to lay down rules, or give advice, in reference to capital. The years vary a good deal with regard to the chances they afford of entering on farms favourably. In the spring of the present year, 1889, for example, cattle were at least thirty per cent. higher in price than they were in the spring of 1888, and a still greater disparity is seen if we compare the autumn of 1888 with that of 1887. Those who entered on dairy farms in the autumn of 1887, or the spring of 1888, have seen their capital increase very considerably in consequence of pure expansion of values. Men should watch these fluctuations, and go in when prices are low.

## BREEDS OF DAIRY CATTLE.

ON no other equal area of the earth's surface can be found so much variety and wealth of cattle, indigenous to the country, as on that which is called "Great Britain"; and it is indeed a proud inheritance to which the farmers of this country have succeeded, generation after generation, during hundreds of years. Some portions of the continent of Europe are also rich in this bovine wealth, but none of them are equal, or nearly equal, to the British Islands, either in variety or quality of dairy cattle. What this variety in our case is owing to may not be authoritatively stated; but if we look at a geological map of England and Wales we find a wonderful variety of outcrops; and we may be excused for believing that these different formations have played their part in evolving our 'teens of different and distinct breeds of cattle. Our climate, too, is variable, and this has had its influence, no doubt, though we cannot say to what extent. Be these things as they may, the fact remains that our cattle are certainly the admiration, and probably the envy, of farmers in many other countries. Some of these have drawn largely upon our cattle for the improvement of their own, and it has been noticed everywhere that the prepotency of the British breeds is very remarkable; and this prepotency is, in itself, conclusive evidence of constitutional vigour, as well as of fixity of type. Whether our breeds of cattle, transported to, and bred in, other lands, will or will not retain these qualities in their pristine excellence and

vigour, remains to be proved. So far, the results would seem to point to the probability that our cattle will always be in demand to replenish and reinvigorate those of various other regions, particularly of America; and in this event the breeders of superior stock in this country will find a permanent and profitable market abroad. With this in view, added to the perennial demands of our own country, which are constantly increasing, there is plenty of inducement for British dairy farmers to go on improving the quality of our different breeds of cattle.

SHORTHORNS.—The following remarks appeared, under my name, in *The Dairy*, a monthly "Journal of Practical and Scientific Dairy Work," recently established :—

"Under the influence of soil and climate, aided by natural and by artificial selection, the one, perhaps, almost as consciously intentional as the other, was laid the foundation, many centuries ago, of the world's most celebrated and most generally useful breed of cattle, namely, the Shorthorns. The climatic and geological influences of the counties of Durham, York, Westmoreland, and Northumberland, of whatever nature they may be, had no doubt a potent effect in forming, in those long anterior times, the characteristics which, after centuries of modelling, have made the Shorthorn breed the most celebrated that has yet existed, or, perhaps, will exist, on this earth of ours. In the latter half of the last century, and the first quarter of the present one, the breed was generally and generically called 'Durhams,' because in the valley of the Tees, in the county of Durham, were found the brothers Robert and Charles Colling, who, more than any of their contemporaries, demonstrated the capabilities of the Shorthorns for milking, for early maturity, for attainment of

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great size, for aptitude as beef-producers, and for symmetry and beauty of form. The breed, therefore, is, in its antecedents, essentially a north of England breed, though it is now found almost everywhere on earth where bucolic agriculture is progressive and advanced.

"We have no evidence that the art of breeding was either valued or understood very much several centuries ago, but tradition says that a breed of cattle much resembling those of North-western Europe had long existed in the Holderness district of Yorkshire, where much excellent grazing land is to be found. Whether or not they were introduced into England by the Scandinavian invaders of this country centuries before the Norman Conquest, is not known, and cannot ever be known with certainty; but, if they were, a debt of gratitude should mingle with one of a different kind to those ancient free-booters who scoured the Northern Seas and harassed the shores of Britain. Content must we, therefore, remain in this age with the fact that we are the original owners of the Shorthorns, which must ever be regarded as an essentially British breed. A very interesting bit of ancient evidence may still be seen on the walls of Durham Cathedral, which inferentially testifies to the antiquity of the breed. The image of a Shorthorn cow, not unskilfully graven for the period, appears on an outer wall of the sacred building, high up above the ground, and, if my memory serves me, the image of a milk-maid as well; and tradition says that some of the ancient monks, travelling through that country, were once benighted, had refreshment from the milk of the cow, and were directed by the milk-maid, and that, out of gratitude, they caused the incident to be perpetuated in the building of the cathedral. The cow in stone may be taken to fairly

illustrate the Shorthorn of the period, possessing characteristics of form which have since been developed and improved.

"Whatever may have been the influence of the soil and climate of Northumbria in forming the breed which is now so well and widely known, it is not fair to suppose that no man had, in the early days, consciously or unconsciously, tried to improve the cattle of the district. So early, indeed, as the middle of the 17th century, the Aislabies of Studley Park, and the Blacketts of Newby Hall, had paid great attention to the breeding of their cattle, and we may well assume that they were not the first to do so. They were followed in the same line by Milbank, Smithson, Pennyman, St. Quintin, Maynard, Hutchinson, and others, long before Messrs. Colling succeeded in making their herds so singularly famous throughout the land. The year 1780 is said to mark the beginning, coincidently with the advancing prosperity of the country, of a new era in the career of the Shorthorns. The art of breeding improved ; animals, particularly sheep, had then already attained a very high degree of perfection in the hands of the great Leicestershire farmer, Robert Bakewell, of Dishley, and to him the brothers Colling, themselves already on the high tide of fame, went in search of fresh inspiration. No record is available of what was discussed between these famous men, for Bakewell, unfortunately, was not one of those who committed his method and secret to writing, nor do we know that his disciples were more careful for the advantage of posterity ; but in any case it is well known that the reputation of the Shorthorns advanced, by leaps and bounds, from that period.

"The property of copious milking was generally pos-

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sessed by the Shorthorns of last century, though many of the leading tribes have lost it in the present one. This falling away from what is, or ought to be, one of a cow's chief excellencies, is the Shorthorns' misfortune and not their fault. The flow of milk which exists naturally in cows, and is developed artificially, becomes, after a time, hereditary in them, and this flow the early Shorthorns possessed in a high degree. But, in modern times, the question of milk was considered of second or third rate importance, or of no importance at all; and in far too many breeders' hands it was deliberately subordinated to early maturity, to beef, and to beauty, in these cattle, with the lamentable result that many fashionable cows of the breed do not yield enough milk for the sustenance of their own offspring. The fault of this system of breeding is, however, now clearly seen and felt, and milk is again claiming the attention which it ought never to have lost. In the domain of beef, the Shorthorn cannot, all points considered, be surpassed, and she is known to be a good milker, too, wherever she has had anything like a fair chance like the rest. Over the face of the earth the Shorthorn is spreading, and I have seen many noble specimens of the breed on the other side of the Atlantic, away from Prince Edward Island to the foot-hills of the Rocky Mountains, tens of thousands of them roaming, in splendid freedom, over the great ranching country of the North West of Canada."

A hundred years ago the Shorthorns were practically confined to the northern counties of England. Their fame was then becoming general, and a spirit of agricultural progress was making itself felt in the country at large. At that period the prevailing bovine stock of the

midland counties was almost exclusively of Longhorn blood, whose susceptibility of improvement Bakewell had already demonstrated in a striking manner. Yet in less than seventy years the Shorthorns succeeded in almost entirely supplanting the Longhorns in those counties, and this was done by the marked prepotency of the Shorthorn blood. The breed is now established in most, if not all, of the counties of England; predominant it is in many of them, and exclusive in some, as general dairy stock, and it is distributed more or less thickly throughout Ireland, Scotland, and Wales, some of whose native breeds it is gradually displacing. The Shorthorns, indeed, may now be said to be the prevailing cattle in most dairying districts of the British Islands, and, as time goes on, they will, in all probability, become more and more general. The reason for this lies in the fact that they are thoroughly practical cattle for dairy farming purposes, good milkers when properly bred and treated, and superior to most other sorts for the butcher, when getting on in years.

LONGHORNS.—This breed was once common in most of the central and northern counties of England, but it is now only maintained here and there for, as it would seem, antiquarian purposes. The old Longhorns were said to be good milkers, but they had the disadvantage of being slow to mature and to fatten, though their beef was of good quality in a second class. Their horns are always long,—hence their name,—and frequently most inconvenient in form and inclination; they are generally drooping, and sometimes come down and almost meet right under the mouth, several inches below it, so that the animal owning such a questionable adornment can only graze where the grass is tall. As a rule, they have a

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melancholy and woe-begone expression of countenance, as if they were mourning the departed greatness of their race and blood. The breed is not likely to again become even numerous, because, while it is decidedly inferior to the Shorthorn in most respects, it is superior in none.

HEREFORDS.—This breed, as its name denotes, belongs specially to the county of Hereford, where it is still by far the most general, and it promises to hold its ground even against the all-invading Shorthorns. Its deep red all over, save for the snowy white face and the strips of white along the back and underneath the throat, chest, and abdomen, forming a marked contrast, makes it, to my mind, the most picturesque of any English breed, and of any British breed save perhaps the West Highlanders. It is believed to possess considerable antiquity as a distinct breed, though, like the rest, its origin is lost in the hazy dimness of the middle ages. The colour of the Herefords was not always so regularly and distinctly red and white as it is now, for some of the old ones were mottled, and others grey. They are noted most of all for the excellent quality of their flesh, which is said to be superior to the beef produced by any other breed in the world, save that of the West Highland cattle of Scotland; and while they come early to maturity, they fatten rapidly, making, as is claimed for them, a better return than most others for the food they eat. As milkers they do not bear a high reputation, but this is owing to the custom, once quite general, of letting the calf run with its mother, who was not required to give more milk than the calf required. It is now more general to milk the Hereford cows by hand, and their milk-yielding capacity is found to improve so far as to rank them with the Shorthorns. This capacity, indeed, is a natural function

artificially developed in all our dairy breeds, and the Herefords are probably as responsive as any other large breed to training and breeding in this direction.

NORFOLK AND SUFFOLK POLLS.—Here we have one of the most interesting and valuable of the English dairy breeds. Being without horns—an osseous growth far “more honoured in the breach than in the observance”—and a blood-red in colour, all over, these cattle are singularly interesting to look at. One of the most delightful bucolic scenes I have ever enjoyed, was to see a herd of some forty or fifty of these cattle on a park-like slope on the farm of Mr. Manfred Biddell, Playford, Ipswich, who is one of the most famous breeders, in the two counties, of these excellent cattle. Owing, probably, to the absence of horns, these cattle, having no weapons to fight with, are among the most docile of the bovine race. This docility tends toward both milk and beef, for both of which the Red Polls have a valuable reputation; and it must be obvious to any one, I fancy, that cattle are far better without horns than with them; less dangerous to each other, and to those who have the management of them. The breed is not an ancient one in the eastern counties, for it is said to have been derived—at all events in part—from Scotland, whose polled cattle in early times were not uncommonly red in colour, whereas now they are seldom any other colour than black. The Norfolk and Suffolk Polls are as uniformly red, though occasionally with patches of white. An ancient race of polled cattle is said to have existed in Suffolk, but these were dun in colour; and Mr. Storer, in his most interesting book on the Wild White Cattle of Britain, tells of a herd of polled cattle, white and wild, that existed till within modern times, at Gisburne Park, in the beautiful valley

of the Ribble, in Yorkshire, at Middleton Park in Lancashire, and elsewhere, which were descended from the wild herds that once roamed at large in the forests of the county of Lancaster. It is possible, therefore, that in the present race of Red Polled Norfolks and Suffolks we have an admixture of different breeds of hornless cattle, their colour alone being inferential evidence of Scotch blood. This is a study of singular interest to lovers of cattle, but I have not space to indulge in it in this little book.

DEVONS.—The term “self-coloured,”—not a very precise or descriptive one, we must admit,—is sometimes applied to the Devons, because they are of one colour, red, all over, seldom varying from it, if ever, when pure bred; and it is supposed to indicate great antiquity of breed, in a given locality. And so it is that the Devons are said to be the oldest of the distinctly English breeds, free from admixture with other types. The Devons are celebrated more for quality than for quantity of milk, for the quality of their beef, which is next to that of the Herefords, and for hardiness and activity as draught cattle. There are two tolerably distinct types of Devons, besides offshoots from one or both. The North Devons are smaller and compacter than the South Devons, hardier and more active; but in other respects they are very similar—in form, colour, quality of milk. The offshoots are the Sussex breed, larger than either, longer on the leg, and coarser, but still of the same colour, and excellent draught cattle, but poor milkers; and the “Southambers,” also coarser and less compact, less attractive, poor milkers, but good in quality of beef. A changed habitat must be supposed to have made the differences I have mentioned, and, in this, soil and climate have

probably had as much to do as the controlling influence of man.

**CHANNEL ISLANDS CATTLE.**—The Jerseys are probably unequalled for quality of milk, and for the deep, rich colour of the butter they yield. They commonly give a large quantity of milk, though they are not large animals. In form they are deer-like, elegant; in colour, frequently a pleasing silver grey. For centuries they have been treated with great care and tenderness, and to this is probably owing, in common with a genial climate, the exceptional richness of the milk they yield—a quality which is now, and long has been, distinctly hereditary. They are, as may be supposed, delicate animals, not suited to harsh climates and inferior land. Yet are they found to answer well in the United States, and even in Canada, in which countries, however, they soon lose that fawn-like delicacy and elegance which characterizes them in their island home, and sometimes, indeed, attain considerable size. They are essentially milk-producers, but as beef-makers must be allotted a low position in the list.

The Guernseys are also famous alike for quality and quantity of milk, but not for beef. They are larger, coarser, and less pleasing to the eye than the Jerseys, but stronger, hardier, and better qualified for uncongenial climates. These two breeds were formerly called "Alderneys," without distinction, but they are now properly named after the Islands to which they respectively belong; and, indeed, they are undoubtedly distinct as breeds.

**THE AYRSHIRES.**—These cattle, like the Shorthorns, are essentially a modern and composite breed, when compared with the Devons and the Jerseys. That is to say, they contain crosses of different breeds, and have been

carefully improved and changed within what may be called, in reference to cattle, historical times. As milk-producers they are very superior, though their milk is not specially rich like that of the Jerseys and Guernseys. Some Ayrshire cows have yielded as much as a thousand to twelve hundred gallons of milk in a year, and this yield, considered in relation to the size of the animal, is quite wonderful. Their milk appears to be specially adapted for cheesemaking purposes, being rich in casein; but I once had an Ayrshire cow who yielded for a time two pounds of butter per day, besides milk and cream used in the house. Among the hardiest, most active, and most pugnacious of cows, they will thrive where many other breeds would almost starve, and yet they are found to respond as well as any to generous treatment and a genial climate, though as beef-makers they rank but little higher than the Jerseys. The horns of Ayrshires curve inwards and upwards, in good form.

THE KERRYS.—It is perhaps remarkable that the three most famous breeds for milk in the British Islands should be the smallest breeds we have, viz., the Jerseys, the Ayrshires, and the Kerrys, and the last is the least of all. Scarcely bigger than a donkey, the Kerry cow will commonly yield six to eight quarts of milk at a meal, and she is accustomed to find her living on inferior mountain land in the midst of heather and ling, on the roadsides, or in the suburbs of a bog. The Kerry is a demure little animal, patient, and plodding in search of food where food is scanty, and she is regarded, *par excellence*, as the poor man's cow. There are two kinds or types of Kerry cattle, one of which is called the Dexter Kerry—a somewhat thicker and compacter animal, with more bone and hair than the other one, better as a beef-maker, but not as a milker.

The Kerry is the only breed specially original in Ireland, where, indeed, the prevalent breed is the Shorthorn, in the more fertile parts of the country. The Kerrys are, as a rule, black in colour, though at times they are patched with white, and again sometimes red and white, both of which departures are regarded as indicating a cross of other blood. As butter-producers the Kerrys have an acknowledged superiority over many other breeds, their milk being rich in cream; as cheese-producers they have had no opportunity of establishing their reputation, because no cheese worth mention is made in Ireland; this is probably because the climate and herbage of Ireland—the soil rests chiefly on a carboniferous limestone formation—are specially suitable to the production of butter of the best quality. I have examined samples of butter at shows in various countries, and on both sides of the Atlantic, and am free to admit that the best I have seen were in Ireland, particularly in reference to what is known as "body."

**THE WELSH BREEDS.**—The Principality possesses three indigenous or native breeds—the Angleseys, the Glamorgans, and the Pembrokes, or Castle Martins. They are all chiefly black in colour, though sometimes with patches of white, and others are a dark brown or bronze. All of them are hardy in constitution, though rather slow growers, but they cross well with the Shorthorns for beef-making purposes. The Angleseys are the only ones with much reputation for milk. These cattle are about as large as the Ayrshires, but decidedly inferior to them as milkers. They are well adapted to the bleak, mountainous districts of Wales, though they are, in other parts, being displaced by the Shorthorns. It does not appear likely that any of them will make much headway

in the competition of the breeds, if, indeed, they will even hold their own. The fact is that various other breeds are superior, both in milk and beef, and this will turn the scale against the Welsh cattle, as the years roll on. All the same, however, it is to be hoped and expected that they will remain "monarchs of all they survey," in their own mountain fastnesses.

THE SCOTCH BREEDS.—I have spoken of the Ayrshire breed already, in the list of dairy breeds, because they are one of the very best we have in the British Islands. But there are three other breeds in Scotland, beef-producers, all of them, rather than dairy cattle, though the Galloways in any case are very fair at the milk-pail, when trained and bred in that direction. The polled breeds in Scotland are the Aberdeens, or "Angus," otherwise "Doddies," in the north, and the Galloways in the south. Both are black in colour, for the most part, and generally similar in other respects, though the Aberdeens, at all events, were frequently a dark red in olden times. Now and again a red one appears in both breeds, curiously exhibiting nature's tendency to reintroduce a bygone colour. On the College farm at Guelph, in Canada, a small herd of pure-bred Aberdeens is kept, chiefly for educational purposes, for which also there are other breeds at that excellent institution; and I was much interested, in the year 1884, to see there a dark-red heifer, from black parents of the Aberdeen breed. The Galloways are, as a rule, more compact than the Aberdeens, rounder, and shorter on the leg. They are consequently more symmetrical, and nearer to the form and type of cattle our breeders are aiming to produce.

The West Highlanders, immortalized on the canvas of Rosa Bonheur, are essentially a beef-producing breed,

and their flesh is considered superior to that of any other sort of cattle. Belonging, as their name denotes, to the Highlands on the western side of Scotland, they have hitherto roamed in semi-wildness, few of them being really domesticated in the sense that applies to most of our other breeds. With long, shaggy coats, and lively, piercing eyes, hardy as an oak, and active as a goat, they are the most picturesque cattle in the world, eminently in harmony with the wild and beautiful scenery to which they belong. Their colour varies through shades of mahogany, dun, and cream, though each animal has seldom more than one colour. It is probable there are no cattle so hardy as they, for they will keep their flesh in severe winters, pawing away the snow for food, and when spring arrives they quickly fatten.

The breeds of cattle in the British Islands may be summarised as follows :—

In England : Shorthorns, Longhorns, Polled Norfolks, Herefords, Devons, N. and S., Sussex, Southambers, Wild White Cattle.

In Scotland : Ayrshires, Aberdeens, Galloways, West Highlanders.

In Wales : Angleseys, Pembrokes, Glamorgans.

In Channel Islands : Jerseys, Guernseys.

In Ireland : Kerrys.

Perhaps I have said enough in support of the statement that we possess an unrivalled wealth and variety of bovine stock, and it will be perceived that our incipient dairy farmers have ample materials to choose from. Now that cattle no longer roam at large, wherever their own sweet wills would lead them, the number of the breeds will not increase, though it is quite possible that sub-varieties may be established by crossing. But in any case there are at least ten excellent breeds of dairy cattle, and each of

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these will almost certainly be improved by careful selection and breeding. The process is in full swing with most of them; herd-books have been and are being compiled, societies are established, shows are being held, and the arts of breeding and management are more generally understood. Hundreds of wealthy men and thousands of practical dairy farmers are interested in the work, and it will be odd indeed if the next fifty years do not bring about a marked improvement in most of our breeds of dairy cattle.

One of the chief charms of dairy farming is to improve the quality and character of the herd of cows, and to see it annually become better and more valuable. Symmetry of form, quality of skin, vigour of constitution, copious milking, early maturity, are qualities not secured in a day, or without care and judgment. Herein, however, is found an attraction which is permanent, and always fresh to him who takes a pride in breeding good cattle. It is this, in fact, that makes, and will continue to make, dairy farming more popular than the growing of corn, quite apart from the question of relative profit. Indeed, if any branch of farming will be profitable in the future, in these islands, we may be sure it will be dairy farming, when it is well carried out. And dairy farming may be varied by fattening cattle, by sheep husbandry, by the growth of various arable crops, and so on, when the land is suitable to be made into what is called "a mixed farm," with dairying as the salient feature.

## THE EQUIPMENT OF DAIRY FARMS.

ASSUMING that a young man is not very flush of capital, but has just so much as will remind him that he must lay it out to the best advantage in stocking his farm, I may remark that he should look out for the best farm available, and get it at the lowest rent he can. Good land is seldom too dear, and bad land is never cheap enough. Good land needs no improving, and bad land will swallow up in improvements all a man can make. It is a risky thing to improve another man's property, under a yearly tenancy. My father did it, and his rent was raised for his pains. He took in hand an impoverished limestone farm, in the Peak of Derbyshire, which carried twenty-five dairy cows and a flock of seventy ewes. It was full of twitch-grass (*Triticum repens*), the buildings were dilapidated, the fences bad, and the land out of condition. He eradicated the twitch, got thousands of tons of rocks out of the arable land, built miles of stone walls, improved the house and buildings very considerably, boned the arable land two or three times over, and so on, until the farm carried forty-five dairy cows and a hundred and fifty breeding ewes, with young stock in proportion. For many years he laid out all he could make, in improvements, and after all his rent was raised. This, we believe, was the agent's doing; but the landlord, misled of course, forgot old promises. I simply tell the story as an argument in favour of farms that are not impoverished, and against those that are. "A long lease gives a tenant time

to turn himself round," it is commonly said; but a yearly tenancy of an impoverished farm is an arrangement to be carefully avoided. Far better is it for a young man to go to one of the colonies, and farm land of his own.

A new beginner should stock his farm rather sparingly, until he is sure how much it will carry. For, as the old adage says, "it is better to be over-rented than over-stocked"; and the meaning is that if stock are "too thick on the ground" they do but little good, while an over-rented farm can be got rid of. With a limited capital it is good practice to buy second-class cattle of the right sort, and "grade them up," to use an American term, by using good bulls. In this way a man's herd improves each year, after the first two or three, and he has the satisfaction of seeing it improve. Half the pleasure of farming is missing, to my mind, if a man's cattle are so good to begin with that he cannot improve them. Besides, if he buys second-class cattle at a second-class price, he invests a capital which, small to begin with, increases under his eyes, as the improvement goes on. The profit a man makes should consist in part in the increased value which an improved stock will possess. But the bull should ever be a good one, well descended, of a family known to be good all round. "For the bull is half the herd," as some one has wisely said,—that is, he is the sire of all the calves, and they will form the herd later on. The system, as will be perceived, is perpetuated by one good bull after another, right through the chapter. I do not wish to convey the idea that a blue-blooded, fashionable bull should be used, for I really suspect a good many of them. What I mean is that a bull from a thoroughly practical, long-established herd, which has a reputation for all the good qualities which dairy cattle should pos-

sess, should, if obtainable, always be used. Blue-blooded sires have, as a rule, been too lavishly reared, and are not easily kept up to the mark, and their offspring are sometimes very disappointing. To use the inferior, weedy, ramshackle bulls one sees too commonly about the country, is to commit an act of folly which brings its own punishment in the stock which follows. No farmer can properly afford to use low-priced bulls; no farmer can make much money unless his stock is improving, until, indeed, he has got it up to as high a pitch of practical excellence as may be desirable; that accomplished, he will go on making money. It would hardly seem necessary to advise a dairy farmer to always use bulls whose mothers are good milkers, but I do so nevertheless.

It should always be borne in mind that some sort of fitness should exist between the land and the cattle that are put upon it. That is, on good, strong land, large cattle should be placed; and, on poor land, the smaller and hardier sorts. Shorthorns, say, on good land, and Ayrshires on poor. But poor land is scarcely worth having at any price at all, in these days of keen competition. The district, too, should be considered in reference to cattle, and it will generally be found that the cattle belonging to it will answer the purpose very well; all the same, however, it is true that Shorthorns will do well, almost in any district, if the land is suitable, and good enough; and that Ayrshires will do well too, all things considered, wherever cattle can thrive at all. Most of the other breeds, also, are suitable to districts and countries away from those to which they properly belong, and any breed will respond to better land and a more genial climate than those to which it has been accustomed. So far the Shorthorns, much more than any other breed,

have become diffused throughout the whole of the British Islands, and cosmopolitan in reference to the world at large. It is a question of fancy, therefore, sustained by judgment, as to which breed a new beginner shall take in hand. He may take the Shorthorns, Norfolks, Herefords, or Devons, wherever the land is good enough and the climate reasonable, and the Ayrshires and Kerrys almost anywhere that he would go to himself to live, without much reference to land or climate, but the Jerseys and Guernseys only to sound land and a genial climate, unless special care be taken of them. Climatology and geology, and also geography and botany, have a good deal to do with the question. And now let us see what it all comes to, when put into figures:—

Say, 80 heifers and cows, three to five years old, in calf, at £15 each . . . . .	£1,200	0	0
20 twinters (rising two years), of good quality, at £11 each . . . . .	220	0	0
20 yearlings, also of good quality, at £7 each . . . . .	140	0	0
1 winter bull, as good as can be got for . . . . .	40	0	0
1 yearling bull, " " " . . . . .	25	0	0
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Dairy utensils, fittings, fixtures, etc. . . . .	100	0	0
5 horses, with harness, carts, ploughs, har- rows, mower, reaper, etc. . . . .	400	0	0
2 foals, at £15 each . . . . .	30	0	0
Dog-cart, harness, saddle, bridles, etc. . . . .	70	0	0
Tenant-right, manure, forage, etc. . . . .	300	0	0
Household furniture and effects . . . . .	400	0	0
Half-year's rent in the bank . . . . .	225	0	0
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	£3,150	0	0

The foregoing is an estimate for the stocking of a dairy farm of 300 acres, one-fourth arable, and worth 30s. an acre to rent. It is of course only approximative, because

the price of cattle varies in different years, and a good deal depends on the class of cattle bought. It may be increased or decreased ten or twenty per cent., or even more, according to circumstances; but in any case, take one year with another, ten guineas an acre ought to stock a farm very fairly well in all respects. Many dairy farms are stocked with £6 to £8 per acre, and a few perhaps carry a stock worth £20 per acre. Much, of course, turns on the quality of the land, and on the character of the live and dead stock, as well as on the judgment which is employed. From this farm there would be twenty draft cows to be sold each year, and twenty heifer calves would be raised to replace them.

I have estimated for a farm of good strong loam, or alluvial soil, or marly clay, rather too heavy for sheep-breeding, and having one-fourth of its area under the plough. I will now do the same for a "mixed farm" of the same area, with a similar proportion of arable land, part of which is suitable for sheep, on a sandy, chalky, or limestone subsoil, and worth 20s. per acre to rent, and having an invested capital of £9 per acre:—

Say, 45 heifers and cows, three to five years old, in				
calf, at £15 each . . . . .	£675	0	0	
14 twinters (rising two years), of good quality,				
at £11 each . . . . .	154	0	0	
14 yearlings, also of good quality, at £7 each	98	0	0	
2 yearling bulls at, say, £20 each . . . . .	40	0	0	
<hr/> 75				
<hr/> =				
40 three-year-old ewes, in lamb, at 50s. each .	100	0	0	
60 two-year-old     ,     ,     ,     ,     .	150	0	0	
40 yearlings, barren, at 30s. each . . . . .	60	0	0	
3 yearling rams, at £10 each . . . . .	30	0	0	
<hr/> 143				
	<i>Carried forward</i>	£1307	0	0
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	<i>Brought forward</i>	£1307 0 0
5 work horses, with harness, carts, ploughs, harrows, mower, etc., etc. . . . .	350	0 0
2 foals, at £15 each . . . . .	30	0 0
Dog-cart, harness, saddle, bridles, etc. . . . .	70	0 0
Tenant-right, manure, forage, etc. . . . .	300	0 0
Household furniture and effects . . . . .	400	0 0
Dairy utensils, fixtures, fittings, etc. . . . .	75	0 0
Half-year's rent in the bank . . . . .	150	0 0
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	£2,682	0 0

A mixed farm is generally preferred to a purely dairy farm, and it certainly is more varied and interesting, and as a rule quite as profitable. I have assumed a Lady Day entry—March 25th—in which case the in-coming tenant generally takes over from the out-going tenant—who has a sale in November—the forage, roots, and tenant-right, and with them possession of the farm in the early winter months. He can, in this case, begin stocking his farm as early as he likes, and as opportunities offer, without waiting till the spring, and without hurry. It not uncommonly happens, however, that cattle are as cheap in March and April as they are in December and January, or nearly so, in which event, when a man can read with tolerable accuracy what the future has in store, the expense and trouble of wintering may to a great extent be saved. Whenever cattle are dear in early winter, it is safe to wait two or three months; but when they are cheap, it is equally safe to buy at once. A man in the Peak of Derbyshire took a farm in the autumn of 1884, the tenancy to commence at Lady Day, 1885. The out-going tenant had a sale in November, at which the in-coming tenant bought most of the live stock at high prices, filling up from the markets very shortly afterwards, and took over all the

forage, etc., at a valuation. The sequel was that live stock were about the same price in April that they had been in November, and he had consumed all the forage at what was practically a dead loss. Three years later the condition of the markets was reversed, and stock paid well for the wintering. The moral is to buy when things are low in price, and to sell when they are high.

A portion of land under arable cultivation is very useful, and even indispensable, on a dairy farm, because straw, roots, and green crops are wanted,—the two first in winter, and the last in almost any other part of the year. Oats are the most useful white crop on a dairy farm, the straw being better, for cattle, than wheat or barley straw, either for chaffing or for feeding in length. Turnips and ox-cabbages are valuable supplementary food in the late autumn, when grass is scarce on the pastures and has done growing, and when the meadow "eddish," or "rowan," or "aftermath," as it is variously termed, has all been eaten. Swede turnips and mangels are of the utmost service throughout the winter, either for pulping and mixing with chaff, or for slicing and feeding alone. Green rye and winter vetches, *Trifolium incarnatum*, and new "seeds,"—for grazing, if on sound and dry land,—come in very usefully in the month of April, before the pastures are fit to receive the cows.

With eighty acres of land under the plough, out of one hundred and twenty available for arable purposes, there may be twenty of new seeds, or early green crops, twenty of roots, and forty of oats, in the following rotation:—

1st year, oats on ley.

2nd , , roots after oats.

3rd , , oats, seeded down.

4th year, young seeds.

5th " pasture.

6th " pasture.

In this six-course rotation, which is suitable to sound soils, each section of twenty acres would lie three years in grass,—a practice found to suit dairy farming very well,—and there would be one hundred and eighty acres in permanent pasture and meadow. The arable land would be the lighter and drier portion, and the permanent grass land the heavier and damper. Or, if the greater part of the farm were suitable to arable cultivation, with the objects named, the seeded land might lie longer than three years before being again ploughed for oats; or a hundred and twenty acres might be under the plough, giving sixty of oats, thirty of roots, etc., and thirty of seeds, in which event the proportion of permanent meadow would be less than in the former case. The object of arable land on a dairy farm is to provide a greater variety and bulk of crops, and to reduce the area of meadow, leaving the scope of permanent pasture about the same as if there were no arable land at all. With one-third under the plough, the farm will carry more stock than if all the land were in permanent grass, but the expencs are of course increased. Where cows are milked, there must, however, be hands to milk them, and these hands would not find enough employment if there were no arable land, save only in the hay harvest. Arable cultivation will therefore be found a suitable and profitable supplement to dairy farming pure and simple; it may, in fact, very properly be regarded as a part and parcel of dairy farming, on all land which, being dry and sound, is suitable to easy cultivation. And it may be farther

stated that a dairy farm all in permanent grass is too one-sided a thing altogether, and that the balance is only to be found in a due proportion of arable land, and the greater should it be in districts where the land is light and easily worked, if the climate is suitable to the growth of crops adapted to dairying.

Though I personally am not in favour of dairy farming entirely on an arable basis, I am free to admit that where all the land is under the plough, the seeds being broken up after the first or second year's mowing, and the cattle kept for the most part in sheds and yards, with a croft for the necessary exercise, the farm may be made to yield its utmost in food, and possibly also in profit. This system is followed extensively in France and Denmark, and less generally in some other continental countries, with, we must admit, very considerable success. But it is a system demanding constant plodding, "with the water always on the wheel," as one may say. My greatly valued friend, the late H. M. Jenkins, whose death was a great loss to British agriculture, wrote strongly in favour of arable dairy farming, which he had carefully investigated in the countries I have named, and in others too. In his most able, lucid, and exhaustive Report to the Royal Commission on Agriculture, 1882, page 70, he says: "I have frequently pointed out that one of the principal lessons that, in my judgment, English farmers have to learn from their continental brethren is the breeding and rearing of stock, and the making of butter and cheese, on arable land. . . . In Denmark, as I have already reported, permanent grass is almost an unknown element on breeding and dairy farms."

When Mr. Jenkins wrote these words, we had not then been suffering from agricultural depression long enough

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to be convinced that all avoidable expenses must be rigidly cut down to enable farmers to pay their way. Dairy farming was still a paying business, with hopes of improvement, and stock-raising had not ceased to be a profitable pursuit. Since that time, however, a vast area of arable land has been laid down to grass, chiefly heavy land, being no longer profitable at all under the plough. My objection to arable dairy farming being greatly extended in this country is chiefly on the ground of expense, wages of servants being much higher here than on the Continent, and also because the system of landlord and tenant, as known here, does not lend much encouragement to a large extension of arable cultivation, with its increased risks to the tenant. And, again, when we reflect on the long period which generally elapses before a newly-laid down pasture becomes equal to an old one, we shall see that it is wise to "hasten slowly" in the process of breaking up our old pastures and meadows of centuries' growth. All the same, however, I consider that on our lighter soils, where permanent pastures never become first-rate, an extension of arable dairy farming is no doubt desirable. But unless dairying becomes again an attractive pursuit, it is hopeless to expect the extension to go very far; and, indeed, this is hardly likely to occur until foreign competition becomes less keen and searching. The climate of the British Islands, too, is not as favourable as that of France for arable dairy farming.

This much may, however, with tolerable confidence be said; viz., that if farming of any kind will pay in the British Islands, that kind is dairy farming. Whatever the future may have in store for us, we may feel fairly confident of the advantages which dairying, stock-raising, and milk-selling will always relatively possess. We may

therefore just as well lay down our plans for the best, and aim at the largest and most profitable form of production of food, all of which will be wanted by a population which is increasing at the rate of about one thousand per day.

There is already a marked increase in the price of cattle, and well-stocked dairy farms are again yielding a profit. The increase in value of cattle is, however, owing to the decrease in number which has occurred in the past two or three years. This decrease, according to the Agricultural Returns, was no less than 311,893 for the year ending June 4, 1888. Cattle are consequently much dearer than they were two years earlier, and this state of things will continue until the number of cattle again approaches the needs of the country, and in the meantime dairy farmers have a good chance for some years to come—indeed, almost a certainty—of reaping the reward which was denied to them in 1887. Farther, the trade of the country is again improving, and the increase of population still goes on, so that we may hope that a cycle of years profitable for agriculture has already commenced.

## THE BREEDING AND REARING OF CALVES.

THE value of pedigree lies in the greater likelihood of qualities being transmitted. When cattle have been carefully bred on a given line for several generations, and bred only from satisfactory specimens, the qualities aimed at become fixed and hereditary. That "like produces like" is found to be true in reference to well-bred stock, as well as to those which are badly bred. And in this lies the value of well-bred bulls, which I have emphasized before. The greatest care and judgment should therefore be exercised in the selection of sires from herds whose qualities it is desirable to secure. When a man keeps thirty or forty cows, and breeds from them, twenty or thirty guineas extra in the price of a bull is not worth a moment's regret, as between a right sort of a bull and a wrong one. After all, it is only a question of an extra fifteen or twenty shillings per calf, and when they are yearlings the increased cost will be more than redeemed in extra size and quality. Not the highest priced bulls, however, are always the best; far from it; and for my own part I would not willingly go outside the range of practical dairy farmers' stock in search of a bull, but I would go to the best of these that I could find,—to stock that are hardy and healthy, well-formed and big, coloury, good milkers and feeders, and accustomed to a bracing climate. To avoid the mistake of too close in-breeding, it is necessary to purchase most of one's bulls from other

herds, rather than to breed one's own, or to send two or three favourite cows to good bulls elsewhere, with the object of breeding sires for use. Close in-breeding is tempting, we know, in order to fix qualities as quickly as possible, but it brings its own punishment, if carried too far, in the form of tuberculosis and infertility.

Parturient apoplexy, or "drop after calving," and milk-fever, are maladies to which over-fed and pampered cows are always liable. Careful dieting and aperient medicines are preventives, as parturition approaches. Two or three doses of Epsom salts, about a pound at a time, and an ounce of ginger as well, at intervals of a week or so, are useful in cooling the blood and keeping the bowels in good condition, in the last month of pregnancy, if cows are in high condition; and shelter from the rays of a hot sun is imperatively necessary. A mixture of dry and succulent food, sparingly given, is better than either alone and separately. Fever drenches, and others for "mawbound,"—as well as Calvert's carbolic acid and olive oil for dressing the vagina after "drop,"—should always be kept on hand, because delays are dangerous. Every dairy farmer, in fact, should have enough veterinary knowledge to enable him to deal with such maladies, and this may be obtained from the very clear instructions supplied by Day & Sons, of Crewe, along with their valuable medicine chests. Cows should always be in good store condition when they calve, if they are to do well as milkers.

When a cow shows signs of calving, it is advisable to move her into a warm, dry, and airy loose box. Assistance should be rendered at the right time,—that is, when the calf's feet appear,—but the process should not be hurried. It is well to give nature a chance, and help it. A couple of quarts of cold water refresh a cow after the labour

of parturition, and they should shortly be followed by warm oatmeal gruel. These, however, are not immediately needed, if the cow is allowed to lick the calf,—a function, however, which unsettles the cow, if the calf is afterwards taken away, though good for the calf.

THE REARING OF CALVES.—The following remarks appeared over my name in the *Live Stock Journal* of the 9th of February in the current year; and as I have nothing better to say on the subject, I reproduce them here:—

"In any given district where dairy farming is pursued, it is probable there are almost as many ways of rearing calves as there are farmers who rear them. When I say this, I mean that the method followed by any two men will hardly ever be identical in every respect. The universal practice is, however, in the first three or four weeks of a calf's life, to feed the young quadruped almost exclusively on the milk of cows. The period during which the calf receives cows' milk, and nothing else, save a little short, sweet hay, varies more or less on every other farm, and even on each individual farm, in reference to different months and to different years. Generally speaking, the calves which drop earliest have the longest spell at the milk-pail; because, particularly on cheese-producing farms, when cheese-making once begins, the calves, young and old together, are begrudged by the dairymaid every drop of milk they receive. The milk is all wanted for the cheese-tub, in fact, and the calves must perforce get something else; and what that something else is will depend on the mental as well as the fiscal resources of the farmer himself. I do not propose in this article to lay down any hard and fast rule of feed-

ing calves, but only to give a short account of what is considered good practice in one place or another, and of what I have been in the habit of doing myself.

"It is generally admitted that a calf should receive its own mother's milk—at all events, while the milk is in the 'beastings' or colostrum stage—that is, during the first four or five days succeeding parturition. In this period some of the casein of the milk is in the form of albumen, gradually becoming casein, and the milk may well be supposed to contain some medicinal property or other, which is, perhaps, specially adapted in the economy of nature to the given calf of a particular mother, rather than to another one. This, we may say, is a point that is conjectural rather than proven, and the evidence in favour of it is presumptive rather than determined, though probably correct. In any case, however, a young calf should receive colostrum during the four or five days designed by nature; for while the young animal's digestive organs are delicate and sensitive, in this early period, colostrum is easily digestible and perfectly suitable. In a state of nature, or when running at large, though domesticated, a cow will never let her calf suck more than a small quantity of milk at any one time, particularly in the first few days. Her teats are tender then, and she has not yet become accustomed to the calf and to its demand upon her for sustenance, so she simply moves on, and the calf must wait a little, until she is again in the humour. This is nature's way of checking a calf's greediness; and so it stands to reason that a calf brought up by hand should be allowed only a little quantity of milk at a time, and should have that little often, at all events during the first week of its existence. Far more harm is commonly done by giving a young calf too much food than by giving

it too little, and a careful manager will always see to this. During the first week, then, a calf should be fed sparingly, four or five times a day, and the milk should be at the natural temperature, viz., 95° to 98° Fah. Calves drink too greedily, as a rule, and it would seem probable that sufficient saliva can hardly become mixed with the milk. This, however, cannot be obviated without the use of an artificial teat—an idea which was put in practice years ago, and which appears to be sound. I have not, myself, tested artificial teats sufficiently to give a final opinion upon them; but my opinion, so far as it goes, is favourable to them. All the same, I admit that many calves thrive well on greedy drinking.

"After the first four or five days the calf should receive milk—not colostrum—in obedience to the custom of nature, and there is now less need to feed it sparingly and often. As a matter of fact, it may be said that a calf will do very well, at all events when it is a week or ten days old, if it is fed twice a day, but even then it should not be allowed to drink all it will or can. The pail should be removed while the calf is still able and willing, and even anxious, to drink some more. My impression is that a careful attention to this feature of the process, is better than allowing a given quantity of milk to all calves alike, of the same or similar age. But it certainly involves careful watching, and when the work is left to servants it is probably as well to limit each calf to a given quantity. It must be borne in mind, however, that calves' appetites and digestive capacities vary a good deal, that each calf's appetite and requirement may vary on different days, and that to feed by strict rule of measurement does not properly meet the case. It is advisable that each calf should receive fresh milk during the

first three weeks, during which time it will have become vigorous enough to assimilate other kinds of food less strictly in harmony with nature, and it will have learnt to nibble a little sweet hay, or grass if there is any, out of a net or a rack.

"I have found it a good plan, after the first three or four days, to put a pinch or two of condimental meal into the milk given to a calf, and, within reasonable limits, this practice may well be followed so long as the calf receives liquid food at all from the pail. The condiment stimulates digestion, gives tone to the intestinal organs, and is, as a rule, an effective safeguard against scour, or undue relaxation of the bowels, which is in many places a cause of much fatality. A handful of oatmeal, carefully dried, is also a good thing to put into the milk after the first week is over, and it will gradually accustom the calf to greater changes of food later on. There are various special preparations in the form of mixed meals, partly condimental in character, which are found to be very useful when fresh milk is cut off, and skim-milk is employed instead ; and at this stage a supply of boiled linseed—slowly boiled for several hours, and then allowed to cool—is most valuable to replace the fat which has been removed from milk that has been skimmed. These calf-meals, powerfully aided by boiled linseed, with skim-milk as a basis, answer the purpose very well indeed, when once a calf, being healthy and vigorous, has got over the first three weeks ; and even the skim-milk may be dispensed with—for it is not always and everywhere available—and its place may be filled by whey, or even by water. But skim-milk is capital food.

"Calves dropped in February or March will, as a rule, be fit to turn out in a croft, in the day-time, some time in

May, and they will quickly take to grass as supplementary food. But, before turning-out time comes, they should be taught to eat linseed cake, and this is easiest done by putting bits of it into their liquid food; and, if they have been receiving boiled linseed, that will have prepared them for linseed cake. Now, *this linseed cake should be continued until they are a year or fifteen months old*, that is, until they are turned out to their second summer's grass. Linseed cake, indeed, is the only effectual preventive out of many that I have tried for 'black-leg,' on a farm subject to that malady. The quantity of cake young calves will eat, when they are out on their first summer's grass, is not much—say  $\frac{1}{2}$  lb. to 1 lb. each per day; but as autumn wears along they will eat a little more, and in winter they will eat 2 or 3 lb. per day, or perhaps even 4 lb., along with hay, sliced roots, and salt rock to lick. Anyway, even if they eat 4 lb. each per day, it will be found to pay, for they will come out well and big and strong in the spring, and what they eat in cake—say two shillings' worth each per week—they will save in something else, and will leave some excellent manure behind them. My remarks have reference now only to calves that are raised as practical dairy farmers' stock.

"In the rearing of calves it is of the utmost importance that the sheds should be well drained, well ventilated without draughts, not too warm, fresh, sweet, and clean. Without due attention to these points, it is hardly possible to keep young calves healthy, no matter how carefully they may be fed. A calf-house, well constructed, having a slotted, removable floor, and effective drainage, is a valuable equipment on a dairy farmer's premises. In reference to the treatment of calves in the winter suc-

ceeding their first summer, I am strongly of the opinion that they are better not tied by the neck, but running loose. Sheds they ought to have to run under, where they get their cake and hay, and these should either be attached to an open yard, which is littered, or in some convenient, well-sheltered field. Where the land is dry and sound, I should prefer it to open or even covered yards, for calves are healthier out in the air, provided they have good food and adequate shelter."

Mr. Sheldon, of Brailes, who has long had one of the most distinguished herds of Shorthorns in England, wrote as follows to the same *Journal*, and on the same date:—

"My shorthorn calves all suck their dams, lying with them for the first fortnight or so, and then being brought to them twice a day. When able to eat they have hay, and later some pulped roots, bran, oilcake, etc. The female calves go out to grass in the summer succeeding their birth. The bull-calves, of course, must be kept in boxes and yards, and have plenty of roots and green food, as well as hay and some cake. Their thriving depends more on the attention and care of the feeder than on anything else. He should watch the state of their bowels, and feed accordingly. Many calves are spoilt by having too much nitrogenous food, which gets them into a feverish state. It is utterly impossible for any one to specify exact quantities of food that would be suitable to every calf, as it must be regulated by their strength, their appetite, and powers of digestion, all which require to be watched and suited."

Mr. Evans, of Burton, Lincoln, whose dairy Shorthorns

have been very successful, writes as follows, also in the same *Journal* :—

"The season of the year makes so much difference in the treatment of calves that we will roughly divide them into winter and summer calves. *Winter Calves.*—We usually leave the calf with its mother in a clean loose box till it is three or four days old, getting what milk we can from the cow in order that the calf may not have too much. We make a cow rear three or four calves—two at first for about four months, then one or two afterwards, according to the time of year and quantity of milk she may give. Sometimes a heifer will rear only two. We prefer to go for number of calves fairly reared rather than few extravagantly done; and where you have a number to deal with, we think there is no better way than rearing them on the cows. Milk substitutes may be made useful to help out a short supply of milk, or by giving them to calves weaned young. When, then, a cow has calved three or four days we put two calves to her, suckling them twice a day—night and morning. We think this better than letting them run together, as both cow and calves rest better separately, and the calves can be fed alone, a subject we shall come to later on. For the first fortnight the chief evil to guard against is 'scour.' The calf pen must be clean, warm, and there must be plenty of fresh air over the calves, not too many together, and above all they must not have too much milk. This is the chief cause of the mischief. It is better to draw a little from the cow night and morning for a couple of weeks (the latter half of a cow's milk containing as it does more cream is more digestible for young calves), till they can digest the whole; also keep the cows without

turnips. ‘Too little milk does not kill—too much sometimes does.’ Arrived at the age of two or three weeks, do the calves as well as you like—they should have a wisp of hay to pick at, with later on as much as they can eat, a handful of mixed food in a tub, say linseed cake, bran, and bruised oats; increase this to 2 or 3 lb. per head when they will eat it. If more calves are to be reared, the first batch may be taken off at four months old, put into a warm, airy place, and given 4 lb. each—a mixture of linseed cake, crushed oats, bran, peas, hay, and a peck of sliced roots, or, better still, cabbage—they may perhaps now be taught to drink a little milk substitute to advantage. Now as to summering these calves six or eight months old. We have often seen calves this age turned out fresh in the spring, lose their condition in the summer, and come up in the autumn bigger but no heavier and worth no more money. Calves at this age summered entirely at pasture are very likely, especially on low-lying land, to get hoose or husk towards autumn; then when taken in the yards and made to improve in condition, they are more liable to black-leg or quarter-evil, than if kept steadily growing the whole time. If at any time they do shrink, it is advisable to seton them as a preventive, when they begin to improve. If it can be conveniently managed, we believe they thrive better kept up all the summer on tares, etc., second crop of clover, and about 3 lb. of cake per day. We usually run our calves in a paddock, bringing them into an adjoining crew-yard at night, and give them a little hay and about 3 lb. of mixed cake. They then go into the yards early in autumn, and have, say, pulped turnips and cut straw twice a day, hay once with 4 lb. of cake and 2 pecks of sliced roots. We consider that calves of this age require

as much cake to keep them going as older beasts do.

*Spring and Summer Calves.*—We think it better to avoid cows calving in May, as the new grass flushes the cows' milk, and gives more trouble with the young calves; better have the calves a month or six weeks old, if possible. The remarks given above for very young winter calves will still apply. In summer we prefer to keep the calves in an open crew-yard with shed, bringing the cows in to them twice a day, and feeding them as before described. After being weaned in autumn, these calves require liberal winter food, say 4 lb. mixed cake and corn, hay and roots. We believe that young stock grow and thrive better with a liberal supply of roots, and these certainly make the food more palatable. The great object to keep in view is to retain the calf-flesh, and to keep the animal always thriving."

In Mr. George Simpson's well-known herd of Jerseys at Wray Park the treatment is as follows:—"The calves when first born are sprinkled with salt, so that the cow may be induced to lick them dry. They are taken from the cow about the third day, and have little cloths of rough flannel tied on them. This is of course only in the winter, and the trifling expense and trouble is well repaid by the greatly reduced tendency to scour. They are given three quarts of new milk during the day in three meals, the milk being mixed with equal parts of hot water, so as to bring it up to blood heat. At six weeks old they are gradually shifted on to skim-milk, still mixing with warm water. By the time they are eight to ten weeks old they are on four quarts of skim-milk, and now small quantities of ground linseed cake and coarse bran are given them, and a little sweet hay. The milk and water is gradually weakened, and the cake, etc., increased

till the calves are eating solid food and drinking water. When out at grass they want nothing more after they are four to five months old till they are twelve months, unless they are weakly, or the weather is bad. Some calves will drink too much at a time, and get out of shape in consequence; this must be guarded against. Again, some calves have a tendency to suck others; they should be watched, and if they do so, try wiping their mouths dry after drinking milk; if they still do it, separate them. Of course all these remarks apply to average calves, sickly small ones want extra or different feeding and much care. Above all, keep the calf-sheds clean, this precaution being most necessary with milk-fed animals. A little Sanitas powder strewn about is a great deodorizer.'

Calves should be kept in a nicely progressive condition, never being allowed to lose the calf-flesh; but it is a mistake to force or pamper them, unless, indeed, they are being fattened for the butcher, in which event the quicker the process is completed the better, within the limits of discretion. This progression needs careful watching, in order to maintain the balance, until the time when the calves are allowed to look after themselves on the pastures or in the yards. It is the too early forcing of growth that injures the constitution most; later on, the calf is strong and vigorous, and an increased dietary is comparatively harmless. The first autumn and winter are critical periods, in which the nicely progressive policy is the safest to follow. Calves that are growing too rapidly, or are losing condition, as the case may be, are liable more than others to black-leg, which, as I have reason to know, is a fatal malady. At all events, I have never known a case to be cured; and even if this were not so, prevention is always better than cure.

## GENERAL MANAGEMENT OF CATTLE.

A CARDINAL feature in reference to cattle is found in the fact that well-bred stock, properly fed from the start and not pampered, are quite as cheaply maintained as any other sort. Indeed, it may be claimed for them that they make a better return for the food they eat, quantity and quality being equal, and in this event they either eat less or make more progress. Cattle are not, however, wanted to eat less, for the more they eat the better, within limits, if only they make a corresponding return in milk or flesh, as the case may be. It is a general rule that well-bred cattle, good alike in quality and in constitution, will fatten for the butcher in much less time than will inferior ones. As a matter of fact, one may as well try to fatten a five-barred gate as some sorts of cattle. Force them how you will, they either cannot eat enough food, or they consume a good deal of it to waste. The same is true, though perhaps to a less extent, in reference to milk; for well-bred cattle, in whom the lacteal functions have been properly developed, will give more and better milk than badly-bred ones of the same breed will yield. In all breeds there are bad, middling, and good cattle, and it is the good ones that always pay the best, under suitable conditions. It is obvious that dairy cattle should be bred for beef as well as for milk, though milk is the more important. The chief end and aim of a cow's existence is to produce calves

and milk, both of good quality, and last of all a good carcase of beef. Cattle that breed and milk well, keeping up their flesh all the time, are soon finished off for the butcher, when the inexorable condition of man's convenience requires it. Good fleshed cows are always desirable, in preference to lean kine that are always lean, if only they are satisfactory milkers; they withstand the rigours of a fickle climate all the better, and always command a readier sale.

It should ever be borne in mind that breed counts more than food in the production of milk, for a cow not given to milk will not become a good milker on the best of food; and, indeed, no cow can yield a large supply of milk on scanty rations of inferior food. The thing to aim at is profit, and this is best secured by having cows good for milk and flesh, and feeding them generously. In America a great deal has been written about rations of food for cows in milk, alike as to quantity, quality, and composition, with proportions of the latter for cheese and butter-making respectively. For the former, good food rich in albuminoids, or nitrogenous materials, and for the latter carbo-hydrates. The first-named are represented by such food as bean and pea meal, vetches, clover, etc., and the latter by linseed, potatoes, which are rich in starch, and mangels, which have a good deal of sugar in their composition. All the same it is the quantity rather than the quality of milk which responds to improved and increased food, though at the same time its composition will vary a little. The casein in milk varies less than the butter-fat in amount, and food rich in carbonaceous matter is more likely to influence the quantity of butter-fat in milk than nitrogenous food is to alter the proportion of casein in any appreciable degree. In any case,

the food a cow needs contains four or five parts of carbonaceous to one of nitrogenous ingredients.

Careful investigations into the effect of changes of food on the yield of milk have been made by Kuehn, in Germany, and the following conclusions may be regarded as being fairly well established:—Firstly, an increase of food, sustained in both quantity and quality, increases the yield of milk and also the proportion of solids in it, and the better milker a cow naturally is, the greater will be the effect of the food. Secondly, the proportion of fat in the food bears no special relation to the proportion of fat in the milk, but an increase of fat in the food increases the yield of milk as a whole. Thirdly, while changes in carbo-hydrates only have but little effect on the yield of milk, the increase or decrease of albuminoids finds a response, within limits, in the yield; and while the composition of the solids of milk is not generally and sensibly altered by changes in the composition of the food, there are in some instances striking exceptions to the rule. The general conclusions deducible from these experiments are that the composition of milk in any particular ingredient does not necessarily respond to changes of the corresponding ingredient in the food, and that scientific feeding is followed by results so varying that no rule can be laid down in respect of them save that of an increase or decrease, as the case may be, of the total yield of milk. The composition of milk, in fact, depends more on the breed, or on the peculiarities, of a cow than on the food she eats, and it is equally true that the condition a cow is in will have a good deal to do with the quantity and quality of the milk she gives. Prof. E. W. Stewart gives the following balance of ingredients as a fair one for the production of milk:—

	Albuminoids. lbs.	Carbo-hydrates. lbs.	Fat. lbs.
12 lbs. of good meadow hay	0·65	4·92	0·12
3 „ „ maize meal	0·25	1·81	0·14
3 „ „ ground oats	0·27	1·30	0·14
3 „ „ wheat shorts	0·27	1·64	0·08
4 „ „ linseed meal	1·10	1·32	0·28
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	2·54	10·99	0·76

Mr. Gilbert Murray, of Elvaston, who has done much to improve the dairy farming of this country, gives the following as an average daily ration for a dairy cow in full milk, in winter time :—

	Ibs.
A mixture of chaffed hay and straw	. . . . . 20
Bean meal	. . . . . 2
Ground oats	. . . . . 2
A mixture of wheat and barley meal	. . . . . 2
Linseed meal, or cake	. . . . . 2
Bran	. . . . . 2
Roots	. . . . . 25
Hay, divided into two feeds	. . . . . 5
	<hr/>
	60

This ration is, of course, only approximative, for while some cows will need more, others will need less. It is a good practice to chaff hay and straw together, or straw alone, mixing the pulped roots with the chaff, and letting the mixture lie in a heap until the pulp has softened the fibre of the straw, and mixing the different kinds of meal with the heap before feeding it to the cows. This, indeed, is better than steaming the straw, and feeding the roots separately. Mr. R. E. Turnbull says: "I think it better not to give breeding cattle cooked food, except for a few weeks after calving. I believe the digestive powers of a cow largely fed on cooked food become im-

paired, and though she may yield more milk in winter, she will not thrive so well on the pastures in summer." To steam chaffed hay and straw is no great advantage, save to kill the fungus if they are mouldy, and they are quite sufficiently cooked in the slow fermentation induced by pulped roots. The object in both cases is to make the food more easily digestible, which is soon overdone by steaming. And as roots are better pulped than given intact for the production of milk, the softening of chaffed hay or straw is most cheaply accomplished by their aid. There can be no doubt that mouldy chaff is rendered less hurtful by steaming, but moulded forage is always inferior and sometimes dangerous. Where, however, a steam engine is kept for chaffing and pulping, the steaming of the chaff is a simple and inexpensive process. Straw chaff is greatly improved in digestibility, and even in quality, by being mixed with about five per cent. of its weight of chaffed green food of some kind—grass, vetches, clover, etc.—and stored for a few months, or longer, during which interval a slow process of fermentation is in progress. It should be well trodden down in a binn or silo, and a bushel of salt per ton should be scattered amongst it as it is being stored. Cattle of all ages should generally have at least two feeds per day of unchaffed hay or straw, to promote rumination, and to prevent indigestion.

The chaffing of hay and straw causes all to be eaten up cleanly; and when some of it is out of condition, it may be improved for any description of stock by the addition of meal of one sort or another. It is, however, unnecessary to chaff good hay, save with the object of improving chaffed straw, which can, of course, be otherwise done by the aid of meal and brewers' grains, or pulped roots,

Brewers' grains, indeed, which should always have been themselves improved by a few months' storage in air-tight pits, are better used along with chaff, otherwise cattle eat them too rapidly. Grains that have been well stored for months, or even for a year, are not only better and healthier for stock, but will go farther than new ones. The slow process of fermentation has made them more suitable for the stomach, and also improved their quality. Used in moderation, they are a valuable supplementary food for many kinds of live stock, especially for cows and ewes in milk, stimulating the lacteal organs and giving a tone to the stomach. But a too free use of them will lower the quality of the milk and impair the organs of digestion.

A cheap and handy way of wintering barren stock, young and old, is to feed them on oat straw unchaffed, if it is good, sliced roots, and linseed cake. Yearlings should not be wintered this way, but twinters, and older barren stock, and even late calving cows, may be carried through the winter in a satisfactory manner on straw, and roots, and cake, at a minimum outlay in money and trouble. Straw that is eaten without chaffing should be softened for a few hours by water thrown over it, in order to make it easier to masticate and digest. This is a simple expedient, worth trying. Decorticated cotton cake is one of the best auxiliary feeding stuffs that can be used, especially for adult cattle and such as are being fattened for the butcher; but I should never give it at all to yearlings, and not much of it to cows in milk. The flavour of it is soon perceived in butter and cheese, to their disadvantage. Its manurial residue is higher in value than that of any other kind of food supplied to stock, whether artificial or natural food, and no other manure will pro-

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duce such crops of hay, of good quality. Cattle do not eat it as freely as they do linseed cake, and I usually give my fattening beasts half and half of each. The careful farmer will watch the markets, and buy such kinds of feeding-stuffs as are cheapest; and he ought to learn all that is necessary about the relative worth of the different sorts, as regards both their feeding and their manurial value.

The natural food of cattle is grass, when they can get it, and fog in winter. In a state of domestication, however, they are provided in winter with artificial food of one sort or another, and with natural food artificially preserved. In summer the natural food, grass, is about the best they can have, yet even grass may be profitably supplemented by artificial food, within limits that are not very wide. An early pasture is always welcome in spring, and the best land, or land in the best condition, is ever the farwardest, in a given locality, and under similar conditions as to warmth and shelter. The grass and hay yielded by such land is superior in quality to, and will go farther than, that from inferior land out of condition. For, after all, it is not so much a question of bulk, as of nutrition, that makes the difference; but when there are both, the gain is all the greater. Again I may say that while good land can scarcely be too dear, poor land is seldom cheap enough. On every given pasture there is so much grass as food for stock, and if ten cows will consume it all, it is a mistake to put a dozen upon it. Cattle do best on grass when they can fill themselves in a reasonable time, and then lie down to rest and ruminate. Too much exercise taken in search of food, reduces alike the quantity and quality of the milk a cow will give; so will exposure to storms or to a burning sun; and so also will chasing by

flies, or dogs, or men. In all these cases a larger proportion of the food is used in restoring tissue, and producing heat, rather than in making milk or flesh.

The quality of grass, we may say, depends on the quality of the land, and on the condition it is in. Some land, otherwise good, produces an abundance of herbage whose tendency is to unduly relax the bowels of cattle; in such cases the cattle should receive daily a few lbs. of undecorticated cotton cake, whose astringent property is a corrective of relaxation. A dressing of four cwt.s. of superphosphate of lime per acre will often materially improve the condition of such land, as indeed of any kind of grass land that is sour, damp, or otherwise out of condition, will sweeten the herbage and increase the variety of grasses, as well as the proportion of the best sorts. The consumption by cattle of cake and corn will increase the productiveness of land, which, attended to in these several ways, will carry a heavier stock each succeeding year. I am simply relating the course and result of my own experience. Such improved land, in fact, has longer seasons, for they are lengthened at both ends,—are earlier in spring, and hold out longer in autumn. The difficulty indeed with land in high condition is to keep the grass down bare enough, and it must not be allowed to get too good a start in the spring. The way to prevent this is to turn out the cattle upon it as soon as there is a fairly good bite of grass, and so keep it down; the grass on poor land, on the contrary, needs a good start in the spring, by way of encouragement, as it were, or the pasture will be bare all the season.

In the humid and temperate climate of the British Islands, it is not likely that any other system will greatly supplant the time-honoured depasturing of dairy cattle,

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though an extension of arable dairy farming is no doubt desirable on some of our lighter soils. Where the sun does not smite them by day nor the moon by night, to use a sacred figure, dairy cattle are best out on the pastures, healthier, more vigorous, and so on. Yet must we admit that the system of depasturing is not the most economical of food, though it may be the more profitable. What I mean is this: in depasturing grass, instead of mowing it for use in the sheds and yards, there is more waste through trampling upon it, etc.; but it may after all occur that the system shall leave a larger net profit than feeding in sheds, simply because the expenses are cut down.

The question is one for individual taste and judgment, but in any case dairy cows should have a plentiful supply, in spring, summer, and autumn, of grass of good quality, supplemented when it is scarce by different green crops, grown on arable land; and the object should be to make a farm carry all the stock it conveniently can, and to yield a maximum supply of food for the ever-growing wants of a rapidly increasing population.

## ENSILAGE.

THE practice of storing green forage, in pits, is of great antiquity, though not in this country. In Eastern Europe it has been followed, as we understand, from time immemorial ; and it was known in France long before it attracted attention in England. Pliny speaks of it as having been adopted in Greece, Spain, and even in Africa ; so that the idea is old enough, though its developments are quite modern. In the *Journal* of the Highland Society in 1843, Professor Johnson gave a description of the German system of making "sour-hay." It was again described by my predecessor at the Royal Agricultural College, Professor Wrightson, who, after a visit to Austria-Hungary, in 1874, drew attention to it in the pages of the *Journal* of the Royal Agricultural Society of England. On page 351 of the *Journal* for the year named, he says :—"The system of making 'sour-hay' is also well worth the attention of English agriculturists. It is done by digging long graves or trenches, 4 feet by 6 or 8 feet in depth and breadth, and cramming the green grass or green Indian corn tightly down into them, covering the whole up with a foot of earth. The preservation is complete, and the wetter the fodder goes together the better. No salt is used, and the operation is as simple as it appears in the description."

For some years afterwards, as is usual with Englishmen, no interest worth speaking of was taken in the matter, and then all at once it sprang into notoriety.

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The wet seasons of the last decade, culminating with 1879, caused many persons to regard it with anxious favour, but not until many of them had figuratively burnt their fingers in trying, by the aid of "exhaust-fans," to finish haymaking in the rick. Not a few of these burnt their ricks as well, in reality; and now may be bought, at a small outlay, a good many second-hand exhaust-fans. Many costly silos have since been erected, and still more that are not very costly. New buildings have been put up, besides many old ones that have been adapted, and various kinds of mechanical pressure, from levers and screws to hydraulic rams, have been employed, as well as a simpler dead-weight in the form of stones, or barrels of sand, and so on, in order to press the silage solid and to exclude the air. Many silos have had carefully constructed drains, trapped and air-tight, to carry away the sap which flowed from the pressed forage. Drains, however, do not appear to be necessary. An old friend of mine, in the moorlands of Staffordshire, Mr. Hope of Elkstone, has had a silo in use for some years, in which there is no drain of the kind, and he considers that if any sap collects in the bottom it rises again into the mass of forage; in any case he finds no liquid to speak of at the bottom, and so there is no waste. His opinion of silage as a winter food for dairy cows is quite favourable, providing it is carefully preserved and discreetly used. It can only be used with success as a supplementary, and not as a chief, food for dairy cows in milk. Too much of it will often give an unpleasant taste to the milk, as too many turnips will. Used in moderation, however, and mixed with hay or straw, chaffed or otherwise, it is found to cause an increased flow of milk, the butter from which has a better colour and quality than that from hay alone. The easily

digestible character of silage is perhaps its most important property. In mastication, as well as in digestion, the labour of the animal machine is reduced, and to this is owing in no small degree the improved quality and condition of the butter.

That our countrymen do not take up a new process in a careless manner is well seen in the progress which the system of ensilage has made in recent years. Already, indeed, silos find a powerful rival in silage ricks. The grass is simply made into a rick, like hay, but tightened down by screws or levers working from the bottom, with chains or wire ropes over the top. Admitting the greater amount of waste silage in a rick, it is claimed for the new method that it saves much valuable time in a busy season, and that the cost of a silo is not incurred. The problem of producing sweet silage has also been solved in this country, merely by regulating the temperature. By allowing it to rise to  $130^{\circ}$ , the bacteria which produce acid fermentation are destroyed, and the silage is fresh and sweet when used. It is said to be easier to produce sweet silage in a rick than in a silo. When heavy pressure is applied too early the air is too soon excluded, the temperature does not rise high enough, and the silage is acid. Experimenters will do well to study Mr. George Fry's very interesting book on the subject.

## MILK.

THE number of cows and heifers in calf and in milk, in the British Islands, in the month of June, 1888, was 3,853,000, showing the considerable decrease of 93,000 in one year. During the same period the total number of cattle decreased from 10,639,960 to 10,268,600, or no less than 371,360. As a consequence, the price of cattle of all sorts and ages has advanced very considerably, and milk promises to be comparatively scarce and dear for several years to come, because the deficiency will take a long time making up. But if we look back two years, we find that the number of cattle of all ages was 10,872,800, and that the two years' decrease amounts to 604,200,—that is, from June, 1886, to June, 1888. These figures are from the Official Agricultural Returns, which are collected each year on June 4th.

Ten years ago I estimated the average yield of milk by the cows of these islands to be 440 gallons per cow per annum. I am disposed now to raise the estimate 20 gallons, because a good deal of attention has been paid in the interval to the improvement of the milking properties of cows. The yield of milk on this estimate, at 6d. per gallon, which is perhaps all that farmers on an average are now-a-days receiving for their milk, is worth upwards of forty-three millions sterling per annum. The late John Algernon Clarke, perhaps the leading agricultural statistician of his day, and one of the best of our writers on agriculture, estimated the consumption of milk by our

people at one-third of a pint per capitum per diem, or, say, fifteen gallons per annum. This form of consumption therefore disposes of about 555,000,000 gallons, out of a total yield of 1,733,850,000, leaving 1,178,000,000 gallons for cheese and butter, and for the rearing of calves. It is probable that we annually make about 100,000 tons of cheese and about 90,000 tons of butter in these islands, and our importations of these articles amount to about the same quantities. The consumption of cheese by our people does not exceed 15 lb. per capitum per annum, and of butter not more than 14 lb., so that, as it would seem, there is room for an increased consumption coincidently with an increased production. If the people of London consume milk at the rate estimated by Mr. Clarke, it will require upwards of 160,000 cows to supply them with the lacteal fluid, about the same number to supply them with cheese, and double the number for butter. Therefore, London requires the services of more than 600,000 cows to supply it with dairy products alone,—milk, cheese, and butter; and this is putting the consumption at the lowest estimate that is at all likely to be approximate.

Milk is required by law to have a standard quality, at the lowest, of  $8\frac{1}{2}\%$  of solids not fat, and  $2\frac{1}{2}$  of fat,—together  $11\frac{1}{2}\%$  of solids. The average quality of milk may be stated as follows:—

Water	.	.	.	.	.	87·25 per cent.
Casein	.	.	.	.	.	3·50 "
Butter	.	.	.	.	.	3·50 "
Milk Sugar	.	.	.	.	.	4·60 "
Albumen.	.	.	.	.	.	0·40 "
Ash	.	.	.	.	.	0·75 "

and it will vary in extreme cases from:—

Water . . . .	83·65 to 90·00 per cent.
Casein . . . .	3·00 „ 5·00 „ „
Butter . . . .	1·80 „ 5·20 „ „
Milk Sugar. . . .	3·00 „ 5·50 „ „
Albumen . . . .	0·30 „ 0·55 „ „
Ash . . . .	0·70 „ 0·80 „ „

Neither casein nor butter is in solution in milk, but rather in suspension—the butter-fat expressly so. Casein appears to be in the form of an extremely attenuated jelly, owing to lavish absorption of water; but it is not dissolved, or it would pass the membrane of a dialysator. It is soluble in diluted hydrochloric acid, or carbonate of soda, and it is coagulable by rennet, and by lactic acid, and may be precipitated by various acids. Coagulation by rennet, which is the active agent of digestion in the fourth stomach of a calf, is the only one that can be employed in cheese-making, for it is the digestive agent alluded to which has so much to do with ripening and mellowing the cheese after it is made. And a well-ripened, mellow, buttery cheese is easily digestible on account of the presence in it of this agent, which itself has gone on increasing in volume in the ripening cheese, and it assists in the digestion of other food that we eat,—hence the why and wherefore of our taking a bit of cheese the last thing at dinner. The absence of cheese is felt by those who have been accustomed to it, and herein lies the scientific aspect of the lament expressed by our great dramatist, in the following sentence:—

“ Why, my cheese, my digestion, why has thou not served thyself in to my table so many meals? ”

Butter-fat, in the form of cream-globules, is easily seen by the aid of a microscope to be in suspension in milk, and each globule is a separate entity. These globules

belong to the "infinitely little," for a single pint of milk, containing 4 % of cream, has been estimated, by Soxhlet I think, to contain no less than the prodigious number of forty thousand millions of them. The diameters of the globules vary a good deal in all milk, and in the milk of different breeds of cows, or in that of different cows of the same breed, sometimes; Sturtevant gives them at  $\frac{1}{100}$  to  $\frac{1}{50}$  of an inch. Milk, indeed, is an emulsion, in which the most valuable ingredient is the butter-fat. The specific gravity of cream is about .90, whereas that of milk containing cream is about 1.30, water as a standard being 1.00; and it is this difference in specific gravity which causes cream to rise to the surface of milk that is at rest. Some of the cream-globules, however, have the peculiarity of being stationary, while others appear to gravitate slowly downwards, and hence it is that the whole of the cream never succeeds in reaching the surface of the milk.

The well-known American dairy expert, Professor L. B. Arnold, who has recently died, tells us that cream rises quickest in a falling temperature. He says:—"Water is a better conductor of heat than fat; hence, when the temperature of milk varies up or down, the water in the milk feels the effect of heat or cold a little sooner than the fat in the cream does, therefore the cream is always a little behind the water in swelling with heat or shrinking with cold—thus diminishing the difference between the specific gravity of the milk and cream when the temperature is rising, and increasing it when the temperature is falling." It is no doubt true that a falling temperature assists the cream to rise, for it rises rapidly when a can of milk is placed in an ice-water bath whose temperature is 40°, or less, and the milk rapidly loses its warmth. But specific gravity must be still more potent,

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for cream will rise when the temperature of the milk is stationary, at  $40^{\circ}$  or at  $80^{\circ}$ , or even above or below these figures, within limits. In a room whose normal temperature is, for instance,  $50^{\circ}$ , it is advisable to set milk deeper than in one at  $70^{\circ}$ , because shallow milk will cool more rapidly than deep milk, and Arnold thinks a slowly-falling temperature is best in the open-pan system of cream-raising. This, however, is not of much moment, for in a cool room the milk will keep, whether deep or shallow, and the cream will rise. It is the warm room that is the great trouble to butter-makers. A perfect milk-room is one that is cool, clean, dry, well-ventilated, and tolerably uniform in temperature. These qualities are obtained in rooms set in hill-sides, almost or quite below the level of the ground, well drained, and having double walls and roofs, with an air-space between them. Such an air-space, indeed, is valuable in all dairy rooms, because it provides an air-cushion which considerably reduces the variation of temperature within the room, as between winter and summer, or as between a cold day and a warm one, coming perhaps, in our variable climate, immediately one after the other. It also makes the rooms dry, and this is also a valuable feature. But for the fact that we see many instances to the contrary, it would seem superfluous to say that milk-rooms should be situated far enough away from an impure atmosphere, if possible, and that nothing should be kept in them but milk,—nothing, I mean, that has a strong or unpleasant odour. For milk absorbs such odours, and atmospheric impurities are apt to repeat themselves in the butter or cheese.

The question of temperature, however, materially influences the absorbent capacity of milk; for, so long as the milk is warmer than the atmosphere of the room, it gives

off rather than attracts odours. Cold air coming in contact with warm milk is expanded and rises, and its capacity for holding gases, vapours, odours, is increased, so that it attracts volatile odours from the milk, and may even be made to purify it to some extent. But if cold milk be placed in a warm room, the moisture of the air condenses on the surface of the milk, and with it the odour of the room is deposited. And hence it follows that a low atmospheric temperature is the best for a milk-room; but when the temperature of the room and of the milk are equal, or when that of the milk is lowest, the milk-pans are better covered over to shut off free contact with the air. Milk that has been cooled by water or ice should not be exposed to an atmosphere ten or twenty degrees warmer, for it then becomes a facile condenser and absorbent. While the air is seldom pure enough not to injure milk that is ten degrees colder, it is seldom so impure as to vitiate milk that is ten degrees warmer. It is of course expedient to remove milk at once from the odours of the cowhouse to the comparatively pure air of the milk-room, yet there is no special need to do so on the score of contamination, so long as the air is colder than the milk. Yet are the odours of the cowhouse often traceable in the milk, and it is thought they get into it by absorption; this may be so, and will be so when the air is warmer than the milk, but they oftenest get into it through the lungs of the cow. It is therefore an excellent thing to have cowhouses well ventilated, and kept as clean as possible. Acid silage vitiates the atmosphere.

Dairy rooms should be cool, clean, dry, and well ventilated without draughts. They should also have what is called "a dim, religious light"; for a strong ray of light falling on milk will sometimes cause specky or streaky

butter, while a draught may disturb the surface of milk and interfere with the rising of the cream. The floor of the room should be well laid, in order that there may be no crevices in which spilled milk may lurk and ferment; and the walls may be similarly spoken of, while both

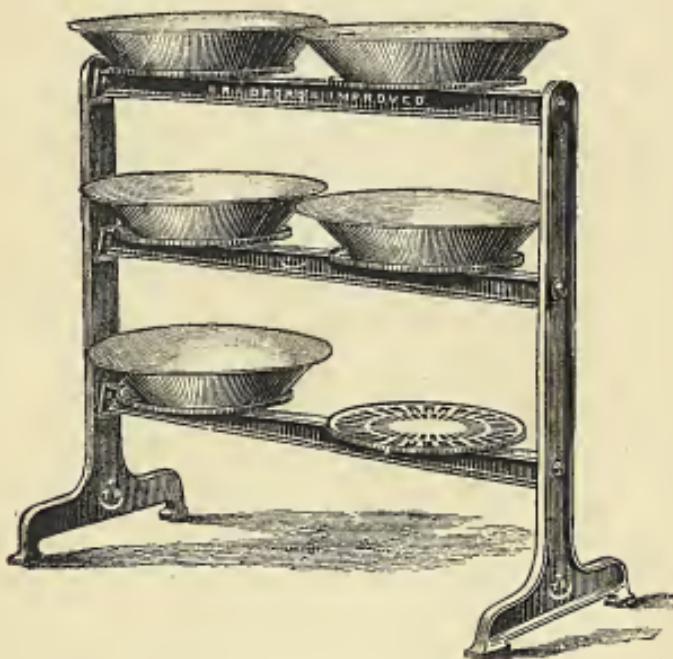


FIG. 1.—BRADFORD'S REVOLVING-DISC MILK-STAND.

should be easy to clean. Concrete answers well for floors, showing no joints; the Staffordshire tiles supply us with many attractive patterns for walls, and with a material whose glazed surface is easier even than glass to keep clean. Under-ground drains are to be avoided, for they are apt to choke up or become foul, and are difficult to purify.

There are various kinds of milk-pans, the best being either of glazed porcelain or of enamelled sheet-iron. These of course are seamless, and are cleaned with the greatest ease. The milk-pan stand, with revolving discs, seen in Fig. 1, and made by Mr. Bradford, is a dairy equipment which I can fully recommend. The revolving discs, on which the pans stand, greatly facilitate the process of skimming.

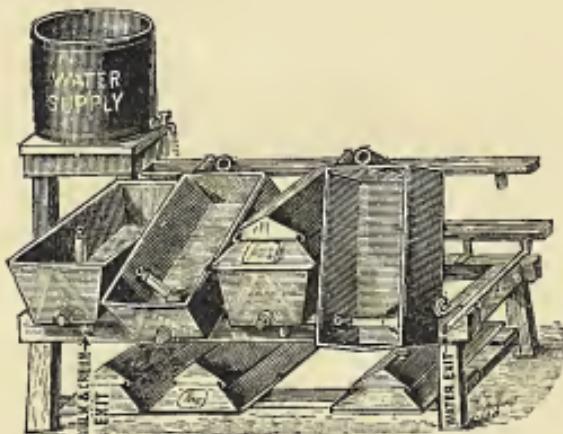


FIG. 2.—THE JERSEY CREAMER.

The Jersey Creamer consists of one or more pans that have double sides and bottoms, between which are spaces for hot or cold water, and over the pans are lids constructed to act as ventilators, and to aid in raising the cream. When the milk is below 90° Fahr., the spaces should be filled with boiling water, in order to raise the milk up to 110°. The hot water is then drawn out, and the spaces filled with cold water, 45° to 60°, which is conducted through taps, as seen in the illustration, Fig. 2, and is

allowed to run at least till the milk has fallen to the temperature of the water. The effect of first heating the milk up to  $110^{\circ}$ , and then cooling it to  $60^{\circ}$  or lower, is to cause the cream to rise in twelve to fifteen hours. When the cream has risen, the space is emptied of water, and the taps are stopped; then the skim-milk is drained away, leaving in the bottoms of the pans the cream, which, in its turn, is let out through a tube. The Jersey Creamer is sound in principle, and simple and effective

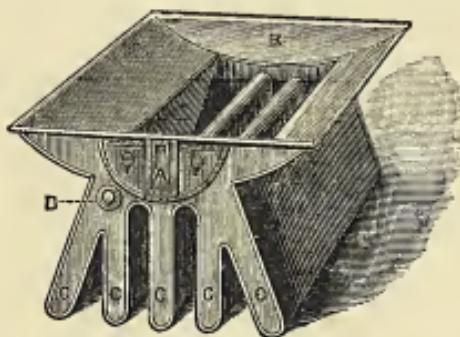


FIG. 3.—“SPEEDWELL” PATENT RAISER.

in operation. It is an adaptation and improvement of the Orange County Milk Pan, and the Centennial Creamer, both of which are American adaptations of an early Danish type.

The “Speedwell Cream Raiser” is a new invention, which raises cream in two to four hours. It consists of a series of cells, marked “C” in Fig. 3. Milk is put into it to cover the cells, and it is placed in a bath of the coldest water available; it is then filled with milk to the upper line of the glass eye-piece “A.” When the cream has risen, a little of the skim-milk is run off through the

outlet pipe "B," in case it is desired to leave a portion of the cream in the skim-milk; but if all the cream is to be removed, the skimmer, as seen in Fig. 4, is used before any of the skim-milk is run off. The skimmer removes the cream—the whole of it—by one turn of the wrists, after which the skim-milk may be poured out from the

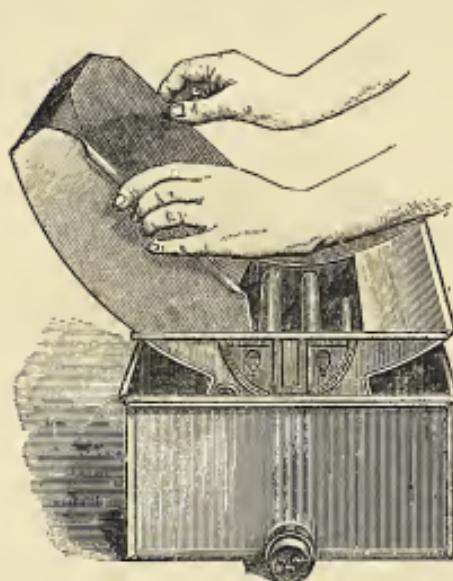


FIG. 4.—"SPEEDWELL" METHOD OF SKIMMING.

top, and the apparatus cleaned at once. This new item of dairy equipment is made in different sizes, the smallest, holding a gallon, being suitable where only one cow is kept.

I do not expect that the old-fashioned system of cream-raising in shallow, open pans will ever entirely disappear; but it will certainly be greatly diminished by

the centrifugal cream-separator, which is one of the most wonderful inventions of a wonderful age. At the International Dairy Show, in Hamburg, in the spring of 1877, I saw the initial idea of this extraordinary machine, which has since been brought to what we may well sup-

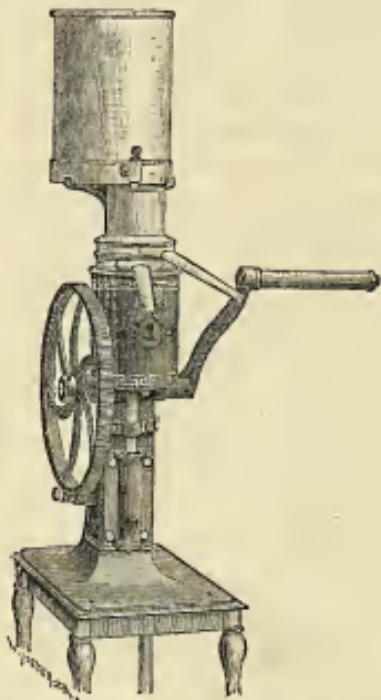


FIG. 5.—THE "BABY" CREAM SEPARATOR.

pose is the highest degree of efficiency, simplicity, and perfection. There are various sorts and sizes of it, from the "Baby," costing £12, which is seen in Fig. 5, to the large machine, costing £45. With the former, a strong boy or girl may separate twelve gallons of milk in an

hour, and it is suitable for small dairies. The milk is placed in the receiver at the top, and flows through the tap, in a regulated stream, into the drum. The skim-milk and the cream respectively flow out through the two pipes that are seen on the upper front. The drum is actuated by means of the handle that is attached to the large cog-wheel, and a very high rate of speed is attained. The application of muscle must, it should be borne in mind by those who think of investing in one of these machines, be steady, regular, and continuous, because a uniform rate of speed is necessary to perfect separation of cream from milk. The temperature of the milk must also be at a given point; but as this varies with different machines, and as no special point is necessary with some of them, the operator must go by the instructions that are issued with each machine. Care must be taken to keep the machine clean, and well oiled in the bearings.

The larger machine of the De Laval type, of which an illustration is given in Fig. 6, is made in different sizes, with a capacity, in the largest, of separating 150 gallons of milk per hour. This is the simplest of the large power machines, having few parts subject to wear, and requiring no very great power to run it, though the necessary speed is very high. The speed is best maintained by steam or water power, because they are the most trustworthy and regular, and water is of course the cheaper of the two. Some machines are driven by horse power, but there are few horses steady enough for the work. This machine may be had with a steam turbine arrangement, in which only a steam boiler is needed. Complete instructions are sent out with each machine. Besides the Laval, there is the Danish machine, a more elaborate instrument, running at a much lower speed, and capable

of separating 220 gallons per hour. Its cost is £75, and it is a favourite in creameries and large dairies.

The advantages accruing from the use of separators are various. The utensils required in an ordinary dairy, specially milk-pans, are largely dispensed with; fewer shelves and less room are needed; the question of temperature is less important; perfectly fresh cream is

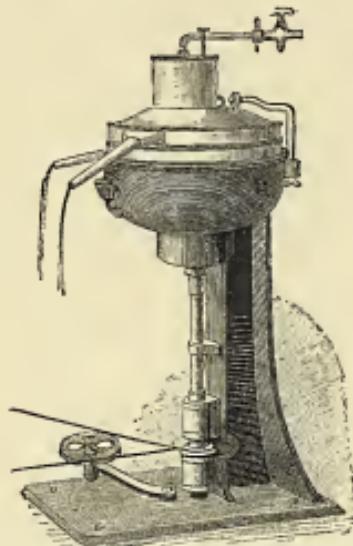


FIG. 6.—THE POWER SEPARATOR.

obtained, and equally fresh skim-milk, which is a great advantage in hot weather. Where there is a sale for skim-milk, it is obvious that a separator is indispensable. The quantity of butter-fat obtained from milk by a separator greatly exceeds that by any other system, and only a mere fractional part of it remains in the skim-milk. Perfectly fresh butter is the result, for it may be ob-

tained within an hour of milking the cows. Yet the cream should be kept a few days. Where calves are raised, fresh skim-milk, warm and inviting, may be fed to them, and it is better thus than stale and cold.

I have elsewhere written:—

"It would almost seem, in respect of quite a considerable proportion of dairymaids, that some mysterious and insuperable difficulty stood in the way of making first-rate butter. Anyhow, there is not much butter that answers to this description, if the complaints we hear and see are a true index to the actual state of things. We have been told repeatedly that the French and Danes and Swedes and Dutch, and even the Germans, can beat us out and out in butter-making, and that the highest-priced butter in the London market is not produced in the British Islands at all. There is, no doubt, a good deal of truth in all this; but it is at the same time true that as fine butter is produced here and there in our insular country as in any part of the Continent; and we may fairly believe that the efforts which are now being made to disseminate sound dairy education will have the effect of greatly increasing the proportion of fine butter made in this country.

"Butter-making, as an art, is a simpler thing than cheese-making; yet, to excel in it, demands the application of sound principles. It must be intelligently pursued from beginning to end—with regulation, with system, with watchfulness. Strict cleanliness in every stage of the work, and the regulation of temperature, are the leading principles, followed by careful attention to details of management. All this, however, formidable as it may seem in the way I have tried to emphasize it, is

simple and easy enough when once the habit has been acquired. Habit, indeed, is almost everything, because there are bad as well as good habits in butter-making, and between them we may discover most of the reasons why there is so much disparity in the quality, flavour, aroma, and condition of butter. And habit is the sequel of training and example, to a great extent; hence the need of intelligent education, supplemented by thoughtful care. The fact is, we do not take pains enough, and we do not study out the matter as we ought to do in its various aspects. Were we to acquire the habit of taking pride in our work, which is so conspicuous among the dairy folk in some parts of the countries I have named, we could easily equal, if not excel, those self-same Continental people in the art of butter-making. Let us examine the question from beginning to end, and see then if we cannot evolve something like order out of chaos.

"Milk is a complex and delicate fluid, quick in absorbing odours, and highly susceptible of fermentive changes. The septic tendencies of milk, its contamination with dirt at milking-time and in unclean vessels, its contact with vitiated atmosphere and with unsuitable temperatures—these are the chief reasons why the produce of so many dairies is beneath its possibilities. Careless lads who need their cars boxing—and careless men too, for the matter of that, who need something else—injure a lot of milk at milking-time; their hands are dirty, and they dip their fingers into the milk, thinking to milk the easier for it, and the filth drops into the pail; or they are too lazy, too wilful, too stupid, to clean an udder that is smeared with dirt, or smothered with dust, before they milk the cow. I am persuaded that more injury is done to milk in this way than 90 per cent. of

milkers, of farmers, of dairymaids, of those who have to do with dairy work, ever dream of ; and hence it is that bad habits such as these, and the friendly familiarity that people have with dirt, are perpetuated from one generation to another.

"Once the milk is delivered into the dairy, the responsibility of the dairymaid begins, and that of the milkers ends—as they suppose. Were it possible for an intelligent dairymaid to milk all the cows herself, there would be no harm done by dirt, for dirt would be kept at a distance. It is not possible, however, save in small dairies, and the next best thing is for the dairymaid to just superintend the milking of the cows. A competent dairymaid, feeling her responsibility and the importance of her vocation, is one on whom careless milkers will not play tricks with impunity. Dirty milk she detects at once, and the delinquent is instantly saddled with the blame. For her own credit's sake, indeed, she is entitled, nay compelled, to look very closely after this part of the matter : in butter and cheese factories the need for such watchfulness is fully understood, for one man's dirty milk would spoil the clean milk of everybody else. The dairymaid, then, is responsible so soon as she has 'passed' the milk into the dairy ; and indeed she ought to be, and ought to feel she is, or where is the good of a dairymaid at all ? Herein lies the reason why farmers' wives are, as a rule, the best dairymaids—they feel the responsibility, and take a pride and an interest in their work, which half atones for imperfect knowledge and defective training in the dairy.

"The care of milk in the dairy, while the cream is rising, is of first-rate importance. Or, indeed, we may say, in reference to this, take care of the dairy and the milk will take care of itself. That is, let the dairy be

scrupulously clean, and well ventilated with pure air, and let the vessels—the pots and pans and kettles and everything—be above suspicion; then will the milk take care of itself. I am assuming now that the dairy is so situated that in the heat of summer it does not get too warm. A correspondent of mine in Ireland has solved the problem of temperature in summer by putting a second roof on his dairy, a light one covered with felt, about a foot and a half above the first. Between the first and the ceiling, at the square of the walls, is a permanent 'air cushion' as he terms it, and between the two roofs a current of air is in circulation, the latter keeping the former cool, and the temperature of the room beneath remains low enough in the height of summer.

"If the temperature of a dairy can be kept down at 65° in the hottest weather, the milk as a rule will keep well enough while the cream is rising; but if the weather is electrical, it is advisable to mix with the milk a little water in which saltpetre, or some other antiseptic, has been dissolved. I have found 'glacialine' a wonderful milk preserver. In any case, the use of saltpetre in moderation is a good thing; in summer it will help to preserve the milk, and in winter it will neutralise the bitter taste which is too commonly found in butter. The aeration of milk before setting it to cream is a most useful operation, though seldom performed as it ought to be. Properly done, the whole of the milk is well exposed to the air, as it is in passing over a Lawrence's refrigerator, and the odour of the cow escapes with the warmth. Aeration, even in the absence of cooling, is of great use in keeping milk sweet in hot weather."

THE RIPENING OF CREAM.—Some persons like butter

from fresh cream, but to my mind it is comparatively insipid, however fresh it may be. In order to have the flavour of butter well developed, the cream needs ripening, but not souring, and the addition of a little salt. The term "ripening" is used to denote the mellowing of cream by keeping it some days before churning. If cream from a

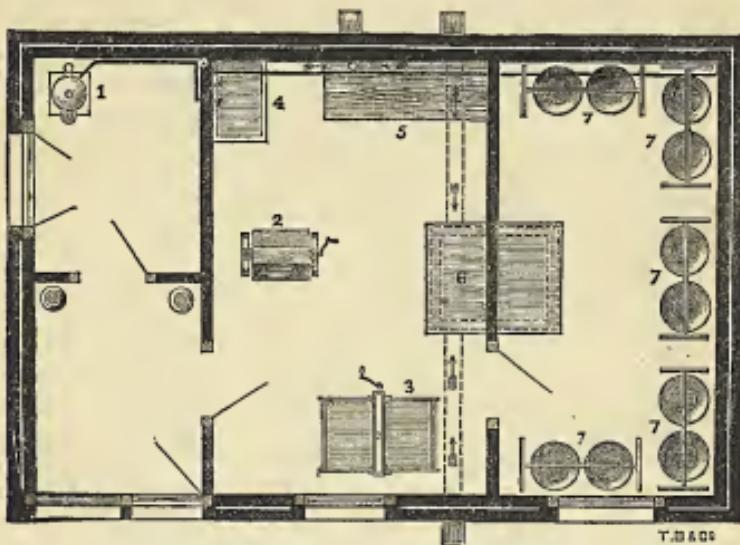


FIG. 7.—BRADFORD'S MODEL DAIRY PLAN.

GROUND PLAN.

No. 1.—Boiler and Hot Water Cistern.	No. 5.—Table.
„ 2.—"Diaphragm" Churn.	„ 6.—Ventilating Chamber, with Slate Top.
„ 3.—"Albany" Butter Worker.	„ 7.—Revolving-Disc Milk Pan Stands.
„ 4.—Washing Trough.	„ 8.—Fresh Air Inlet.

separator be churned at once, the butter is of course perfectly fresh, supposing the milk to have been pure and sweet. Such cream, however, is all the better, and will

churn all the easier, if it is kept a few days before churning it. But if it is kept at a low temperature, say 50° Fahr., it will ripen very slowly, if indeed it will ripen at all in the proper sense of the word. But at 55° to 60° it will ripen, if it is well stirred two or three times a day, and is well exposed to the atmosphere. At a temperature over 60°, the ripening will proceed more rapidly, and care should be taken not to let it proceed too far in that direction before it is churned. If it becomes sour, the ripening has gone too far; and though sour cream will generally churn all the more readily, the acidity injures the delicate and volatile flavouring oils, and the butter is not so choice an article.

On the subject of cream-ripening and milk-setting, the late Professor L. B. Arnold laid down the following rules :—

" 1st, To make the finest flavoured and longest keeping butter, the cream must undergo a ripening process by exposure to the oxygen of the air while it is sweet. This is best done while it is rising. The ripening is very tardy while the temperature is low. 2nd, After cream becomes sour, the more ripening the more it depreciates. The sooner it is then skimmed and churned the better, but it should not be churned while too new. The best time for skimming and churning is just before acidity becomes apparent. 3rd, Cream makes better butter if raised in cold air than in cold water, but it will rise sooner in cold water, and the milk will keep sweet longer. 4th, The deeper milk is set, the less airing the cream gets while rising. 5th, The depth of setting should vary with the temperature: the lower it is the deeper the milk may be set; the higher the shallower it should be. Milk should never be set shallow in a low temperature nor deep in a

high one. Setting deep in cold water economises time, labour, and space. 6th, While milk is standing for cream to rise, the purity of the cream, and consequently the fine flavour and keeping of the butter, will be injured if the surface of the cream is exposed freely to air much warmer than the cream. 7th, When cream is colder than the surrounding air, it takes up moisture and impurities from the air. When the air is colder than the cream, it takes up moisture and whatever escapes from the cream. In the former case the cream purifies the surrounding air; in the latter, the air helps to purify the cream. The selection of a creamer should hinge on what is more desired—highest quality or greatest convenience and economy in time, space, and labour."

In order to keep cream sweet whilst it is ripening, some persons put a little saltpetre into it. Still better is it to use the Dairy Supply Co.'s "Jack Frost" preservative, which is tasteless, colourless, and odourless, and of course perfectly harmless. Cream differing in age, and kept in different "steans" or "crock," is of course not equally ripe for churning, and it is therefore good practice to pour the whole of it into one vessel that is large enough, stir it well a few times, and leave it a few hours in a temperature of about  $58^{\circ}$ , so that it may become all alike. It is good practice to pour acid butter-milk, say a pint to a gallon, into the churn along with the cream,—butter-milk kept over from a previous churning. It has the effect of making the cream churn sooner, of producing more butter, and of hardening the butter and clearing the colour of it. The finest sample of butter I have ever seen was produced in this way, in Ireland.

Before using it, the churn should be well rinsed out with clean water, whose temperature should be about two

or three degrees lower than that of the cream. In cold weather it needs well warming, and in warm well cooling. In cold weather the cream may well have a temperature of  $60^{\circ}$  or  $62^{\circ}$ , when it is put into the churn; and in warm

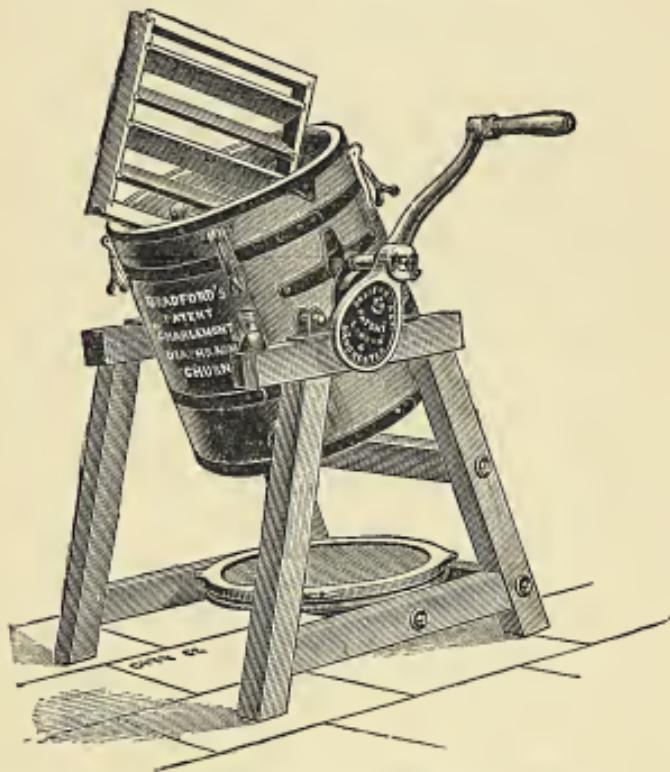


FIG. 8.—BRADFORD'S "DIAPHRAGM" CHURN.

weather it may be at  $56^{\circ}$ ,—the churn relatively corresponding. It must be remembered that in the process of churning, the friction to which the cream is subjected will raise the temperature a little, and therefore the cream

to begin with should rather be a trifle too cool than too warm, according to the weather. But if the cream is too cold, the labour of churning is increased without any corresponding advantage; while if it is too warm the churning is hastened, but the butter is soft. First ripen the cream sufficiently; then "hit the happy mean" as to temperature.

The churn of which an illustration is given in Fig. 8 is the Victoria Churn, enormously improved by the diaphragm arrangement; to distinguish it from others, it is called "The Charlemont Diaphragm Churn." The leading fault of the Victoria is the absence of beaters or mixers; its leading merit the ease with which the butter is taken out of it, and the facility which the open end lends for cleaning the churn after using it. The Charlemont not only avoids the fault, but retains the merit. For my part, I do not expect any system of "beaters," or "dashers," or "mixers" inside a churn will ever be invented to supersede the "diaphragm," which has also the great advantage of being easily removed when the churning is done, of being separately cleaned, and of being left out in the air to dry and sweeten. It is an easy churn to operate, and the agitation communicated to the cream is sufficient to bring butter in a reasonable time. The number of revolutions a churn should make is from forty-five to fifty per minute, as a top speed; but at first they should be fewer, increasing slowly in the first five minutes, and decreasing toward the end of the operation. The warmer the weather, the fewer the revolutions per minute.

All churns should have a valve through which the evolving gas can be repeatedly let off, until no more escapes; and also a circular pane of glass through which

the state of the cream may be noticed from time to time, as the churning proceeds. The valve is really indispensable, or else a plug instead of it, and the pane is a great advantage. Some Victoria churns have a small chamber at one end, into which warm water may be put in cold weather, or cold water in hot weather, with the object of helping to maintain a regular temperature of the cream inside the body of the churn. This device may be a useful one, but it is not indispensable; for if the churn and the cream are both properly prepared beforehand, as they ought always to be, there is no need for it. By noticing the pane of glass, the "breaking" of the cream may be observed; and when the pane is no longer clouded, but comparatively clear, the butter is beginning to form. At this stage the churn should be turned slowly, and be brought to a stand as soon as the butter granules have aggregated like mustard seed or grains of wheat. This, indeed, is the only stage at which the butter may be thoroughly separated, by washing, from the caseous matter held in suspension by the butter-milk. The greater part of the butter-milk should therefore be at once let out of the churn, through a sieve; clear, cold water, or brine, should be poured into the churn, in quantity nearly equal to the butter-milk taken out, and the churn should then be turned slowly for about half a minute. Nearly the whole of the liquid should then be let out, through a sieve as before, and again fresh water or brine be put in, the process being repeated several times, until the liquid comes out nearly as clear as it goes in. Under this process, each particle of butter is thoroughly washed, and, if brine be used instead of water, salted at the same time. Some persons, however, prefer to mix dry salt with the butter, after the latter is washed, and while it is being

worked, in order that a given quantity of salt may be incorporated. For my own part I prefer dry salt to brine, for the reason stated. It should be needless to add that only the purest salt should be used, either dry or in the form of brine ; and if the former, in as finely powdered a condition as may be convenient.

When the butter has been sufficiently washed—and care must be taken not to over-wash it—it will present a beautiful golden appearance in the churn, and it should then be taken out and placed on a butter-worker. If brine has been used instead of water in the washing, no further salting is required ; but if not, the dry salt is easily incorporated with the butter by means of the worker. The triple use of a worker, in fact, is to incorporate the salt, to consolidate the butter into a compact mass, and to press out the superfluous water. And these ends are accomplished without touching the butter by hand. Butter, indeed, should never be touched by the hand, which can do it no good, and may easily do it harm. Few persons have hands cold enough to touch butter with impunity ; besides which a physiological process is constantly going on wherein carbonic acid is exuded through the skin, and this may easily injure the flavour of the butter, even if the warmth of the hand does not soften it at all. So runs Fleischman's opinion.

In Fig. 9 is given an illustration of a most useful article of equipment for a butter dairy, showing the mode of operation. The fluted roller is turned by the handle, and the frame containing it slides backward and forward under pressure. Passing over the butter, the roller flattens out the mass, and, on being turned the reverse way, rolls it up again into a lump. This double process is repeated as often as may be considered necessary ; and

while the salt is being pressed in, the water is being pressed out, and the butter becomes a compact and solid mass. If perfectly fresh butter is desired, it must of course be washed in water, not brine; but this is not often the case, for a little salt always improves and



FIG. 9.—COMBINED BUTTER-WORKER AND TABLE.

develops the flavour of butter, just as it does that of beef or mutton. The quantity of salt per lb. of butter will vary from an ounce downwards, according to taste. One ounce per lb. is heavy salting, and so much is not used save in butter that we desire to keep a considerable time. Butter made from good cream will keep fresh for weeks

without salt, in a room whose atmosphere is free from odours and whose temperature is under 60° Fahr. All the same, however, a little salt improves it, both for keeping and eating.

The "Délaiteuse" Centrifugal butter-worker, of which

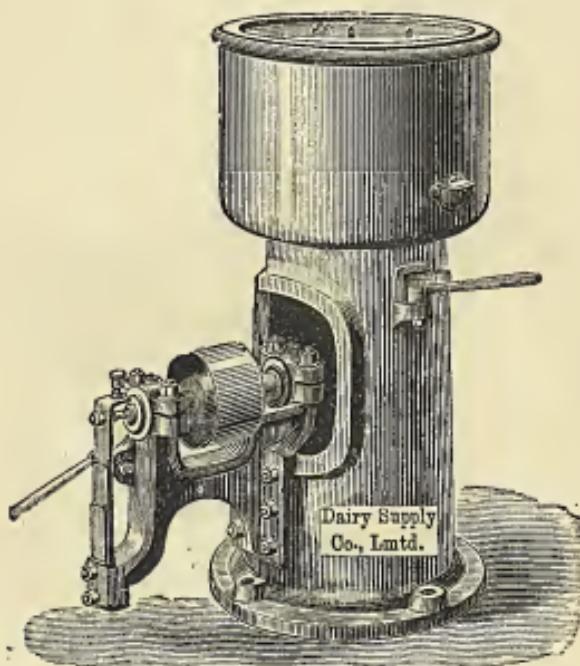


FIG. 10.—THE "DÉLAITEUSE."

an illustration is herewith given, is an invention by whose means butter may be relieved of its superfluous brine or water, after being washed, without any injury to the grain of the butter such as comes of too much manipulation on an ordinary worker; and all that is afterward

needed is to press the butter into a compact body and make it up into rolls or pats. This is best done by boxwood “Scotch Hands,” a pair of which are shown in Fig. 11. Or if the butter is to be preserved for a length of time, it may be taken from the Délaiteuse and put into glazed or porcelain crocks as it is, the crock then being filled up with brine. Or the butter may be salted, packed tightly in crocks, the surface being covered with muslin over which a layer of fine salt, an inch thick, is placed.

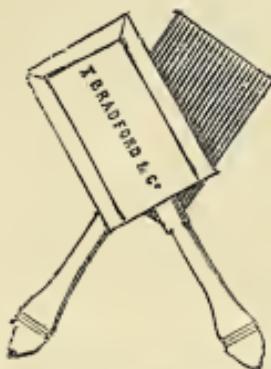


FIG. 11.—“SCOTCH HANDS.”

There are also patented preparations for preserving butter, some of which are effectual and harmless.

Sometimes a phenomenon occurs in churning, known as “sleepy cream,” defying all efforts of the churn to make it give up its butter. The cream swells a good deal, and becomes frothy, emitting sometimes an unpleasant odour. It occurs chiefly in the fall and winter, when the cattle are eating dry food, specially straw, and when they have been long in milk. It may be owing to various causes,—to a late season of the year, to sickly cows, or to the food

they eat, from unclean vessels or a fusty churn, and so on. Scalding the cream, or the use of churning powder, will generally correct the mischief. At other times, and for reasons equally puzzling, the cream will only give up a portion of its butter, and here again the use of butter-powder will usually cause it to relinquish the remainder.

It should be borne in mind that scrupulous cleanliness

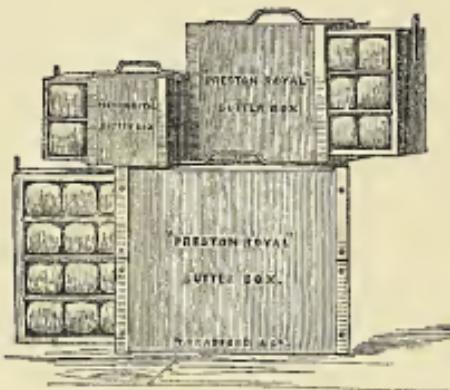


FIG. 12.—BUTTER-BOXES.

is a *sine qua non* in a butter dairy. Dirt of all kinds should be rigidly banished. All vessels after being used should be cleansed with boiling water, scrubbed if necessary, well rinsed with pure cold water, and set to drain. Churns, particularly, require careful cleaning, because they are generally made of wood, and have many joints and corners. Porcelain or enamelled milk-pans, being seamless, and having a smooth surface, are cleaned with ease, and are greatly superior to the old-time vessels of the dairy. With strict cleanliness, however, good butter may be made despite inferior accommodation and

old-fashioned equipments, but it is easier and pleasanter to make it under modern conditions. The chief and perennial lesson to be taught in the dairy is the absolute need of thorough cleanliness ; this attended to, all the rest will naturally follow. Cleanliness, in fact, is the Alpha and Omega, the beginning and the end, of success in dairy work.

For conveying butter long or short distances by rail,

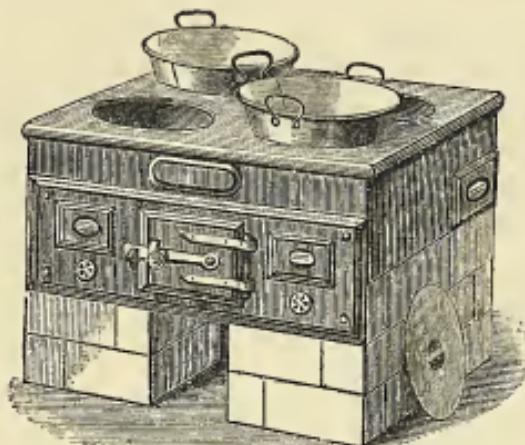


FIG. 13.—BARTHAM'S DEVONSHIRE CREAM STOVE.

Bradford's butter-boxes, Fig. 12, will be found a most useful arrangement. Private customers, hotels, and so on, may be supplied with butter direct from the farm, the boxes being returned empty.

**DEVONSHIRE CREAM.**—Clotted cream is generally associated with Devonshire dairying, because the production of it is an ancient practice in that county ; it may, however, be just as easily produced elsewhere. It is simply a

system of scalding the milk on which about twelve hours' cream has already been allowed to rise, and this causes more cream to ascend. The pans are placed on a stove, as in the annexed illustration, and when blisters are perceived in the cream the pans are removed ; the milk and cream are then allowed to cool, after which the cream is removed and put into crocks, where it thickens and becomes clotted. From cream in this condition the butter is easily obtained by "flapping" or beating, the scalding having had the effect of causing the butter to separate easily from the cream. Scalding the cream is a practice followed in various places, and its general effect is to destroy ferments which may be present, and to facilitate churning. Scalded cream will keep sweet longer than that which has not been scalded, if it is cooled to a reasonable temperature ; but the scalding must be done slowly and with care, or the flavour of the butter may be injured. It does not appear that the Devonshire system possesses so much merit as to lead to its general adoption.

Cream cheese is easily made by pouring thick cream into a perforated box of wood which is lined with muslin. The box may or may not have a bottom, and it should stand where the moisture from the cream can drain away. As the wet leaves it, the cream gradually hardens and becomes fairly solid, when it may be taken out of the mould and placed on straw, exposed to the air. A blue fungus soon appears on the crust, and the cheese is ready for eating. It is made in a cool room, and should become slightly sour. Though there is less art and work in making cream cheese than in making any other sort, success is not always attained at the onset, and it must be remembered that cream cheese will not keep long. The cooler the room the slower the cheese will ripen, and in-

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deed it should not ripen quickly. A room whose normal temperature in summer is  $60^{\circ}$  to  $65^{\circ}$  will serve the purpose well enough, and in winter the temperature may be artificially raised if need be. The demand for cream cheese is limited and irregular, and the price at which the producers will find a profit is one which will not encourage a large circle of consumers. If the same price per lb. could always be obtained for it as butter commands, it would perhaps pay tolerably well; because a given quantity of cream will yield more cream cheese than butter, and the trouble of making the one is about the same as that of making the other, all points considered. Cream cheese contains a portion of casein, and this adds to the profit; whereas butter contains, or should contain, no casein at all, or only the merest fractional proportion of it. Cream cheese, indeed, as the name denotes, is cheese made from cream, as distinguished from cheese made from milk; it resembles the soft cheeses of France rather than the hard ones of England, in appearance and in consistency, as well as in the way it is made, but it is much richer than either in butter-fat.

## CHEESE-MAKING.

THE different sorts of cheese for which England has long been celebrated come under the designation of "hard cheese," as distinguished from the "soft cheese" of France and Germany. The cheese of England is essentially a food, while that of the Continent is rather a relish. It is a food which will sustain a man under the heaviest toil, better, perhaps, than anything else will, and we may doubt if the same can be said of the soft cheese of the Continent. It is, in fact, highly concentrated food, containing a comparatively small proportion of water. Milk, more nearly than anything else, is the standard of human food, as regards the proportions of its constituents; but it is liable to early decomposition, and must be artificially dealt with to preserve it for leisurely consumption. Cheese and condensed milk are the only artificial forms in which all, or nearly all, the valuable elements of milk are held over in a state which is not quickly perishable,—until, indeed, some effectual system of preserving it in its primal form is invented. Repeated scaldings, the last one up to 212° Fahr., and then corking it up in bottles, air-tight, are said to place milk in a condition for keeping an indefinite period; and we are threatened with a large foreign competition in milk, on this basis. At present, however, the handiest way of preserving milk is to convert it into cheese, and a well-made cheese is, as a food for toiling men, without a rival in cheapness and in nutritive

value. The composition of a good sample of Cheddar cheese is about as follows :—

Water . . . . .	84·50
Butter . . . . .	32·20
Casein . . . . .	24·50
Milk-sugar, etc. . . . .	4·50
Mineral matters . . . . .	4·30
	<hr/>
	100·00

Cheese is therefore the concentrated essence of milk, *minus* the greater part of the sugar. The process of cheese-making is analogous to that of digestion of milk in the stomach, and the coagulation of the milk in both is accomplished by the same agent, viz., rennet. In the stomach the milk is coagulated at a temperature of 98°, viz., blood-heat, while in the cheese-tub it is at about 80°, in most English methods of cheese-making. Rennet is an extract from the mucous membrane of the fourth stomach of a calf, and consists of the digestive agent therein contained. The stomach is cleaned, and preserved by salting and drying; when wanted for use, the dried rennet-skin, or "vell," is macerated in brine for some hours, afterwards rubbed to get all the strength of it, and the liquid is put into the milk. At a temperature of 80°, coagulation is slower than at 98°, and the subsequent changes which occur in cheese are slower still; so that while the analogy holds good as to process, it differs greatly as to time employed. The process of digestion is completed in about four hours in the stomach, but in cheese-making it occupies several months, or even years in some cases, until the cheese is ripe. The rennet in the cheese ripens it, or partially digests it; but only very slowly, because of the diminished temperature, and of the salt which is mixed

with the curd, and also because of the reduced proportion of moisture and of lactose, or sugar of milk. A good cheese, well ripened, is an excellent article of food, partially digested.—See page 59.

The quantity of rennet to be put into milk, with the object of coagulating it in a given time, will depend on the strength of the rennet and on the quantity of the milk. If the rennet is strong enough, half a pint of it should coagulate one hundred gallons of milk in an hour. It should always be pure and sweet, free from unpleasant taste or odour, or it communicates its impurities to the cheese. Properly cured with salt, and well dried, the vells are all right, as also will the rennet be if the vells are soaked in pure brine. Some people do not dry them, but take them right out of pickle for use; others dry them, and soak them in whey-brine for use; both these plans are objectionable, on account of the risk of impurity. Rennet extract, carefully prepared, and of uniform strength, is now sold by Hansen and others, and it is being pretty extensively used in preference to that prepared at home. Its uniformity of strength, no less than its purity, invests it with an important advantage; for where rennet of irregular strength is used, coagulation is quicker or slower, and the coagulum firmer or softer, as the case may be, and hence it follows that the subsequent process of cheese-making is hastened or retarded, the cheese harder or softer, the ripening irregular, and the dairy of cheese varied in character.

The character of cheese will also vary from other causes, because the character of milk is apt to vary from changeable weather or from unhealthiness of the cows. Even perfectly healthy milk, yielded by cows of sound constitution and free from disease of any sort, has an acid

reaction, more or less pronounced, which causes it to go sour early when kept at a high temperature. The weather and the season of the year have a good deal to do with this, and the cheese-maker will do well to test it when he has reason to suspect anything abnormal in the way of acid reaction. If a piece of blue litmus paper be moistened with such milk, the tint will change to a reddish-purple or a bright pink, according to the degree of acidity in the milk; and the more decided is the acid reaction, the less rennet may be used, in order not to hasten coagulation, and in this case little or no sour whey need be put into the milk, in systems where sour whey is used at all.

On the other hand, even healthy milk may also have an alkaline reaction, which is sometimes so pronounced as to render cheese-making difficult. This is said to be the case commonly when cows feed on the succulent grass of early spring, or of a wet summer. Such milk will cause feebly-reddened litmus paper to assume a bluish-purple or distinctly blue tint, according to the degree of alkalinity present. When the milk has a very pronounced alkaline reaction, it may be regarded as being unhealthy, probably owing to constitutional unsoundness in the cow, or to some disorganization of the milk-producing organs. In this event the intelligent cheese-maker will employ more rennet, and more sour whey, in order to expedite coagulation and to make the curd firmer; for acidity of course assists the rennet in coagulation, while alkalinity hinders it. Milk which is decidedly alkaline will in the ordinary way slowly produce curd that is soft and spongy, from which the whey will part reluctantly; and the cheese will retain too much moisture, no matter how heavily it may be pressed, and its subsequent behaviour will cause the cheese-maker much disappointment and loss,

—it will, in fact, swell, and perhaps burst, while moisture will run from the cracks, and in the end it will be soft, soapy, bitter, or sweet, according to the turn the chemical developments have taken. Hence it is, indeed, that in systems of cheese-making in which acidity is consciously and intentionally employed the cheese as a general thing is firmer, more uniform in character, and more generally satisfactory.

Milk, indeed, is a product whose idiosyncrasies of character are not generally understood, and hence it is that so much inferior cheese is made. Even to learned experimenters, in fact, milk still possesses various characteristics that are more or less occult and esoteric, alike in cause and result. It is what might be called an uncertain product, open to all sorts of influences, liable to all sorts of changes, and it therefore demands treatment that is calculated to checkmate improper tendencies. It is, we may say, a fragile, varying fluid, intended by Nature to go directly from the udder of the parent to the stomach of the offspring; and, when we take it in hand with a view to preservation, it must needs be treated with care and intelligence. In this there is, or ought to be, no difficulty which cannot be mastered in practice.

## CHEDDAR CHEESE.

THE village of Cheddar, which, in the words of a local minstrel, is

"Famous for capital C's,  
Cliffs, and Caverns, and Cheddar Cheese,"

lies at the foot of the main chain of the Mendip Hills, in the county of Somerset, and on the fringe of the "Marsh," which was a lake when Glastonbury was called Avalon, and which is now one of the richest tracts of grazing land in the county. The solemn grandeur of the ruins of Glastonbury Abbey testifies to the ecclesiastical magnificence of those almost prehistoric times, to which the origin of Cheddar cheese may probably be ascribed. For the ancient monks loved good living, and we may venture to assume that Cheddar cheese was an item in the bill of fare furnished from the huge kitchens of the Abbey. According to Camden, the cheese of Cheddar was famous in the days of "good Queen Bess," as England's maiden monarch has been commonly termed, and it is probably impossible now to discover the period when its reputation was first established. No doughtier champion of the excellence of Cheddar cheese is there than the genial and venerable Archdeacon Denison, and he believes that nowhere outside the limits of Somerset can first-class Cheddar cheese be made, because no other place or country, as he thinks, possesses equal advantages of soil and climate. In a letter to *The Times* of January 3,

1887, he says: "I have a piece of Cheddar cheese lying under a glass on my hall table. It was made forty-one years ago. It is hard now; but it is quite sweet. True Cheddar is always best at two years." It is no doubt true that the finest Cheddar cheese possible is made in Somersetshire; but it is also true that an equally fine article is made elsewhere; and while we must admit that a good deal of inferior cheese is made in that county, we learn with regret that in the village of Cheddar, the ancient cradle of the system which is now the common property of the world, little or no cheese is now being made. The keeping property of the old-time Cheddar cheese is one of its marked characteristics. Slow to ripen, it is slow to decay. But the slowness of ripening is not a profitable feature, whatever the slowness of decay may be, because it involves time, trouble, accommodation, and loss of interest on capital lying idle. The public want cheese that will ripen in three months, and would keep a dozen, sound and good; that will go on ripening and mellowing until, still an edible thing at two years old, a little of it will go a long way. This, indeed, is the sort of cheese which modern Cheddar makers have aimed to produce, and many of them have gone too far in that direction, producing a quickly ripening cheese which in three months' time is past its best, if best it ever attains. This sort of thing has not been done very much, however, outside the United States; where, indeed, most of the dairy abominations with which the current generation is familiar have first seen the light. Oleomargarine cheese, for example, is a cheese which, containing lard and various kinds of slaughter-house offal fat, and simulating Cheddar cheese in form and size, has done incalculable mischief to the reputation of Cheddar cheese, in the minds

of the rank and file of cheese-eaters in England, and it has inflicted on American cheese a disgrace from which it will not recover for a long time, if ever.

A well-made Cheddar cheese is mild in flavour, solid and rather close in texture, full of quality, and mellow, almost, as a pear that is ripe. The size and shape of the cheese is not a matter of much importance, though the general idea is that its height is about equal to its diameter, and that it weighs 100 pounds or more. It is, however, the system on which it is made, and not the size and shape of it, that entitles it to the name of Cheddar. The leading features in the Cheddar system are: the use of heat to regulate the temperature of the milk when it is "set" for coagulation, and for raising it afterwards; the removal of the whey whilst it is still sweet; the development of acidity in the curd; the exposure of the curd to the air, still keeping it warm, and the cooling of it before grinding it; and the mixing of salt *in the curd*, at the rate of about two per cent.

The modern Cheddar cheese vat is rectangular and oblong in shape, the outer shell being of wood, and the inner one of tin or copper. Between them is a space for steam or hot water when the cheese is being made, and for cold water when the evening's milk is kept through the night. The milk is raised to 80° when set for coagulation, varied up to 82° in cold, and down to 78° in warm weather. The coagulum is ready for breaking in about an hour, when it will break over the finger, leaving only moisture behind, and it is very tenderly divided and subdivided by a series of steel blades set about half to three-quarters of an inch apart. The curd then slowly settles, and after a time steam, or hot water, is turned into the space, the curd kept in motion, and the

temperature of the curd and whey raised to 98° or 100°, when the motion ceases. In about thirty minutes' time, or when the maker considers that acid is about to form, the whey is removed, and the acid is encouraged to form in the curd, which is kept warm with that object, and covered with a cloth when necessary. In due time, the curd being distinctly acid, until it will draw out in fine threads on touching hot iron, the curd-mill is put across the milk vat, and grinding is quickly followed by salting and vatting for press. The most effective and convenient press I am acquainted with is seen in the illustration, Fig. 15. The cheeses remain in press two or three days,



FIG. 14.—CURD KNIFE.

or until they are sufficiently solid and compact, being turned and examined twice a day. On being removed to the curing-room, which should be maintained at a temperature of 65° to 70°, they are turned at first twice a day, and later on once a day, and are kept tightly bandaged to preserve the shape, some being on shelves, and others on the floor. The best way of heating a cheese room, or a dairy, in winter, is by a system of hot-water pipes running round by the wall.

**CHESHIRE CHEESE.**—Next to Cheddar, perhaps, Cheshire cheese has the most ancient reputation of any standard British cheese; and, indeed, it was famous in many lands when, probably, Cheddar cheese rejoiced in a compara-

tively local reputation. The Cheshire method, however, has not been reduced to a system in the sense that may be applied to the Cheddar method, nor has its application become cosmopolitan. Both sorts of cheese are made

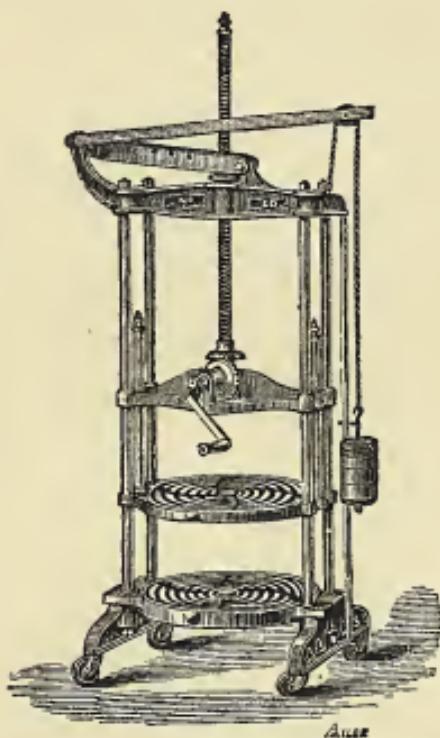


FIG. 15.—BARMAN'S DOUBLE-CHAMBER PRESS.

as a rule in large lumps of 50 to 100 lbs., or more, similar in shape, the weight generally being governed by the number of cows kept at a given farm. Cheshire cheese is at its best in the saline districts of the county,

owing probably to the character of the herbage, but it is also made with success in the adjoining counties of Stafford and Salop. The cheese is made once a day, the evening's milk being kept through the night in the cheese-tub, with cold water under it—running water in some cases. The cream that rises during the night is well stirred into the milk in the morning, unless some of it is skimmed off, and the morning's milk added. The temperature at which the milk is set for coagulation varies with the fancy of the dairymaid, and it does not appear that a thermometer is regarded as a necessary

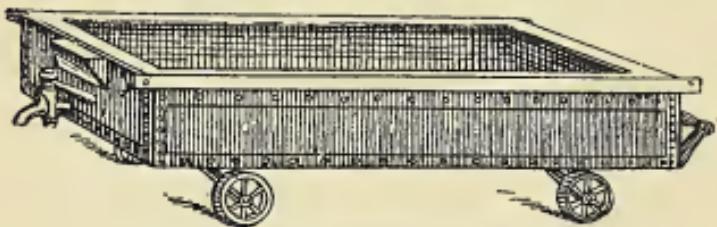


FIG. 16.—BARTHAM'S CHESHIRE CHEESE TUB.

instrument in all Cheshire dairies, though it is where Cheddar cheese is made. Coagulation occurs in forty to sixty minutes, and the curd is broken by a circular implement consisting of wire meshes. After the whey has been removed, the curd is put into a cloth which is placed on a rack in the bottom of the tub, in order that it may drain. Acidity, as a rule, is not developed in the curd, which, when dry enough, is put through the mill, salted at the rate of 3 to 4 lbs. per cwt., and put to press. In many cases, however, the curd is left loosely in the press-vat, which is put into a warm oven for the night, during which it may be expected that some acidity

will develop. During the process of pressing, the cheese is daily turned and dry-clothed, and skewers are inserted through holes in the vat, to facilitate the escape of superfluous whey. It has been said that the use of bones on the Cheshire pastures has made cheese-making difficult, and lowered the reputation of Cheshire cheese; this, I have reason to believe, is a popular fallacy. It is probably true that pastures greatly improved by bones produce a richer herbage, requiring increased intelligence on the part of the dairymaid; but if the reputation of Cheshire cheese has been injured in modern times, it is owing to the evening's milk being too much skimmed, and not to the improvement of the pastures. The sale of milk from Cheshire farms has greatly reduced the volume of cheese-making, and will reduce it still more, for the county is within easy reach of the great towns of Lancashire, and milk-selling to good customers is better than cheese-making. Many excellent dairies have been provided for their tenants by the landlords of Cheshire, notably by Lord Tollemache, in which every convenience and equipment that experience can suggest has been embodied. It is probably correct to say that Cheshire is ahead of every other county in this respect, at all events on the leading estates; and where landlords have taken so worthy and active an interest in the welfare of their estates, it has generally been followed by the prosperity of the tenants. All through the past ten years of agricultural depression, the best Cheshire cheese has commanded a remunerative price, as indeed a first-rate article always will.

**DERBYSHIRE CHEESE.**—The cheese of Derbyshire is essentially a middle-class article, without any specially distinguishing features, and it has not attained a reputation

in other countries like that of the Cheddar, the Cheshire, or the Stilton. It is not in any sense a fancy cheese, but rather an honest, practical, attractive article of food for the working classes, and as such it is popular in some of the great colliery and iron districts, and in the manufacturing towns. The way in which it is made is simpler than that of most other kinds, and the appliances used are fewer and homelier as a rule. Good dairy accommodation is the exception rather than the rule in Derbyshire, the farmer's kitchen being commonly the room in which the cheese is made, and the cheese-rooms are, or used to be, too frequently the servants', and even the family's, sleeping rooms. The northern half of the county is on the carboniferous limestone formation, the land being sound, though not generally rich, and the herbage good, though not very vigorous. On such land good cheese can be made, though less of it per acre or per cow than in many other counties, or in the southern half of the same county. A great deal of the limestone land has been improved by cultivation, re-seeding, and the application of bones, and all of it is particularly healthy for stock.

As in Cheshire, the cheese as a rule is made once a day, and it is only old-fashioned dairymaids who will be at the trouble, when there is nothing to gain, of making it twice a day. It is seldom that a thermometer is used, and the milk is "set" more or less at random and by guess. The evening's milk is too commonly skimmed, and so the quality of the cheese is reduced; but where all the cream is kept in the milk, the cheese, when carefully made, will compare not unfavourably with most other kinds of hard cheese. At about  $80^{\circ}$  the milk is set, and coagulation occurs in about an hour. The curd is then broken, and the whey removed in a sweet condition.

The curd is then put under pressure, in a cloth, frequently cut into lumps, and pressed again. Occasionally it is broken into pieces, or coarsely "crimmed" by the hands, and it must be admitted that the soft hands of a woman will injure and crush it less than any mechanical mill. Lastly, the curd is passed through a mill, or else carefully crimmed, and put into the press-vats, in a cloth, without salt. The following day the cheeses are taken out of press, well rubbed with salt, dry-clothed, and put into press again; the process being repeated for several days, until the cheeses are firm enough to be taken upstairs. It is essentially a sweet-curd process, though during the first night we may assume that the cheese, unsalted, will acquire some acidity. It is obvious that in salting the outside of the cheese, the proportion of saline matter absorbed by the cheese is more or less irregular. A cheese which does not contain much butter will absorb too much salt, and become harsh, and dry, and hard; but a rich cheese, it is said, will only absorb the salt it needs.

My father held for about forty years as yearly tenant the large mixed farm, called Low Fields, not far from the snug market-town of Bakewell, under a landlord who was generous or otherwise according to the mood he was in. The stock-carrying capacity of the farm was about doubled by the tenant's improvements,—a risky thing to do, as I have stated already. Well, the land, once very poor, became rich, and it was found that the sweet-curd system would only produce a second-rate cheese, as to character and uniformity, though it was rich enough in butter. One day it happened that a few pounds of curd were mislaid until too late to include them in the cheeses of the day, and it was decided to put them into

one cheese on the following day, mark that cheese, and watch the result. In this way a most valuable secret was discovered, for the truant bit of curd, which had become acid in the night, kept as it was without salt, communicated acidity to the cheese with which it was mixed, and that particular cheese was the best in the whole dairy! Afterwards all the cheese was made with a portion of old curd, and became a first-class dairy, the entire make of one year, about seven tons, realizing 87s. per cwt.! Acidity, therefore, accidentally hit upon in this case, improves the character of cheese, making it firmer, and improving the flavour, as well as regulating the ripening. In point of fact, most of the mischief incidental to cheese-making is fairly attributable to the want of acidity as a feature in the process, though it does not necessarily follow that sour curd is the best way of introducing it.

It is generally found that late autumn and winter cheese is inferior in warmth and mellowness of flavour and texture, and this may be said to be owing to the evening's milk becoming too cold through the night, and therefore not ripening as it ought to do. The most intelligent cheese-maker I have talked with, told me that he overcame this difficulty by warming the evening's milk, the following morning, up to 80°, and letting it ripen for several hours before making it into cheese. In this way the autumn cheese acquired the mellowness of the summer cheese, and sold for as much money. The milk of autumn is richer than that of summer in solids, though less in quantity, and this may be an additional reason why it needs the ripening artificially that summer milk obtains naturally. It is, in fact, a question of temperature, which is all-important in cheese-making.

LEICESTERSHIRE CHEESE.—It has been admitted that a

first-class dairy of Leicestershire cheese cannot be excelled, or even equalled, by any other kind of English cheese, save the genuine Stilton, in the price it will command. Very fine dairies of cheese are scarcer now than they formerly were in the county, and this is attributed to draining, re-seeding, and otherwise improving the land. Low-lying land, having a cold, marly subsoil, on which a few rushes grow,—land that has not been ploughed for a century, if ever,—is believed to produce the finest quality of cheese, though a less quantity than land that has been improved. It may be said that old turf-land of good quality is favourably regarded, in other counties, for cheese-making purposes; but nowhere than in Leicestershire have I met with practical opinions to the effect that damp land is not the better for being drained, or that inferior pastures are not the better for being improved, where cheese is made. The soils of England, however, are so various in character in the dairying counties, embracing chalk, lias, marl, sandstone, limestone, etc., that the same treatment will not have the same effect on all alike. Anyway, a fine Leicester cheese has a rich, clean, full flavour, a firm and flaky rather than waxy texture, and a general mellowness which makes it very attractive to the epicure in cheese.

The methods employed vary so much in details as to preclude the idea of system, almost every dairymaid following her own ideas as to what is best to do. In spring and autumn the milk is "set" at a temperature of  $80^{\circ}$  to  $84^{\circ}$ , and in summer at  $76^{\circ}$  to  $78^{\circ}$ , sufficient rennet being employed to cause coagulation in about an hour and a quarter, more or less. Success depends on extracting all the whey, and on well curing without over-salting; but when all this is done, a really fine cheese depends

still on the right kind of herbage. It is partly salted in the curd, and partly on the outside,—the latter when the cheese has been pressed into shape.

STILTON CHEESE.—This, too, is a Leicestershire cheese, the first Stiltons having been produced in the neighbourhood of Melton Mowbray. Stiltons are now made in various counties, and even in Canada, but they are mere imitations of the cheese which became famous, a century ago, at the Bell Inn, at Stilton, on the great north road from London to Edinburgh. This cheese was made by Mrs. Paulet, of Wymondham, a relation of Cooper Thornhill, the landlord of the Bell Inn, who “gratified” travellers with it at half-a-crown a pound. Where the cheese was made, and by whom, was for some time kept a secret, after which it was made by various persons. A genuine Stilton is a double-cream cheese,—that is, only the cream of the evening’s milk is added to the morning’s milk, and it is only produced at its best in the five months beginning with May and ending with September, when grass is in good condition, and *old pasture* is considered indispensable.

The evening’s milk is put into shallow vessels, not uncommonly “leads,” and is skimmed in the morning, the cream being put into the morning’s milk for cheese-making, and the skim-milk otherwise disposed of. As in making ordinary Leicestershire cheese, so in Stilton, there does not appear to be any special temperature recognised for “setting” the milk, but sufficient rennet is used to cause coagulation in about an hour. The curd is then a little broken by passing the hand slowly through it a time or two, and left to stand ten minutes, though some persons do not break it at all. It is next put into cloths, whose corners are gathered together, and then into

the leads to drain, the cloth corners being drawn tighter together as the whey drains away and the curd shrinks in bulk. When firm enough it is broken into small pieces and put into the hoops, in layers, with a sprinkling of salt between each two of them. The hoops are turned "other end up" two or three times a day, and when the cheese is firm enough it is taken out, bound up in a cloth, which is repeatedly changed for a dry one, until the coat of the cheese begins to form, when the cheese is put on a shelf in the curing-room. Little or no pressure is applied, and the whey drains out of its own accord; the curd becomes more or less acid, and the blue mould appears in due time as a consequence of exposure to the air. Many Stiltons are now made from "single cream" milk, and are consequently no richer than any other kind of cheese that has been made from unskimmed milk. This has lowered the reputation of Stilton cheese, and a fine specimen is not frequently met with.

COTHERSTONE CHEESE is made in Yorkshire, and is a copy of the Stilton in shape and appearance. Made somewhat similarly, though also in different ways as to detail, it is regarded as a rival of, and by some preferred to, the Stilton; but as its production and consumption are local it is not generally known outside the county.

WENSLEYDALE CHEESE is also a Yorkshire cheese, and local in make and reputation. It is made at a high temperature, and coagulation occurs in about half an hour to forty minutes. The method employed is one of the simplest and shortest to be found, but it is for the most part guess work, and it is not at all likely to spread into other parts. The cheeses are small, varying from five to fifteen pounds, and after being in press for twenty-four hours, are floated in brine for three days.

LANCASHIRE CHEESE has a reputation quite as local as that of Yorkshire, the population of either county being so large as to require far more cheese than is locally produced. I have had occasion to inquire into the methods on which cheese is made in the Fylde country, which is one of the best grass-land districts in the kingdom. Here, as in many other places, details differ so widely that no rule can be laid down. Generally speaking, the method is similar to that followed in Derbyshire, so far as temperature and manipulation are concerned, but in the most successful dairies I have inspected in the district bounded on one side by Preston and on the other by Blackpool, it is the rule to employ acidity in the form of unsalted curd kept from one day to the next. Salting is variously done: in some cases it is partly applied in the curd; in others wholly on the outside of the cheese; and in yet others by means of brine, as in the Wensleydale method. A well-made Fylde cheese is rich and mellow, with a very attractive flavour.

The Southern Counties' Dairying is chiefly famous for Cheddar cheese, but the Wilts "Truckles," and the "Blue-veiny" Dorset Cheese, have each a reputation of their own, the latter resembling the Stilton, and by some preferred to it. "Single" and "Double" Gloucesters have been famous in times gone by, and still are to some extent. The difference between them being simply one of thickness,—the "single" being two to three inches thick, and the "double" four to five, and both about sixteen inches in diameter,—there is nothing to say about them separately, save that the "double" takes a longer time in ripening and contains more moisture. The milk is "set" at 80° up to 85°, and Keevil's apparatus is used in many dairies. The whey is extracted by pressing, after which

the curd is put through the mill and into press, salt being applied on the outside. The Gloucestershire dairies are celebrated for cleanliness, an admirable quality anywhere. The cheeses are flat and level, with well-defined edges, and a clear yellow hue, blue mould rising through the paint on the sides. After the first month they are painted over with Indian red, or Spanish brown, or a mixture of both with small beer, which gives them a pale vermilion colour,—an old-time practice, much resembling that of Holland. This, of course, is a mere fancy custom, of no benefit to the cheese, unless, as some think, it attracts customers.

In Scotland, where Dunlop cheese was erstwhile generally made, the Cheddar system is now commonly followed, and Scotch Cheddars have a well-established reputation. The system was introduced by the late Joseph Harding, of Marksbury, near Bristol, who was the first to reduce the practice to a system, explainable by theory. He was invited by Scotch farmers to explain and practise the system in the south-western counties, and the result is that it now prevails generally in the cheese-making counties, greatly to the benefit of the farmers. Mr. Harding's opinion was this, *viz.*, that good Cheddar cheese can be made in almost any kind of climate, and from almost every kind of herbage,—that it is “made in the dairy, and not in the field, or in the byre, or even in the cow.” Most of all depends, no doubt, on system in the dairy, yet after all the cheese will vary more or less on account of herbage, though probably less so on the Cheddar than on any other method. In any case it is true that the Cheddar system is a marked success in Scotland, as indeed it is in many other countries.

SOFT CHEESE is made in England to a very small extent,

notwithstanding the efforts that have been made to promote it, nor does it appear at all likely that it will attain considerable dimensions as an industry. The taste of the English people is not for soft cheese, and though we import a rather considerable number of these soft cheeses from France, the aggregate weight of them is only a mere tithe of our importations of cheese, and they are chiefly wanted for Continental people living in a few of our largest cities. In the county of Rutland the "Slipcote" cheese is made, much in the way of cream cheese; but, as the milk is coagulated by rennet, it contains the ordinary proportion of casein, and so differs from cream cheese. It is made without pressure, and is ripe in a few days' time; that is, its coat cracks, and is easily slipped off the soft interior,—hence its name. These soft cheeses are a relish rather than a food, and so are not finding much favour in the sturdy stomachs of the rank and file of the English people.

## ASSOCIATED CHEESE- AND BUTTER- MAKING.

ASSOCIATED CHEESE-MAKING originated in Switzerland, a long time ago, and was started in America by Mr. Jesse Williams, in 1851, since which time it has been very greatly developed. The first cheese-factory opened in the British Islands was in the town of Derby, in 1871, an old warehouse being adapted; the second was at Longford, in the same county, in a new wooden building, erected on the estate of the Hon. E. K. W. Coke. These were followed in other years by factories in the county of Stafford, at Hope Dale and Reapsmoor, and again in the county of Derby at Windley, Ivonbrook Grange, Hartington, Etwall, Brailsford, Kedleston, Gratton, and elsewhere, and by yet others in the counties of Chester, Somerset, etc. Later still, Lord Vernon established a butter-factory at Sudbury, and a cheese-factory has recently been built at Rocester, in the same district. On the whole, it may be said that these various items of dairy enterprise have been fairly successful, considering that, since 1875, things agricultural have been going the wrong way; some of them, however, have done considerably better than others. The establishment of cheese-factories was coincident with the expansion of the milk-trade, which soon became more profitable than cheese-making, and hence it was that not very many factories were started in those times. Cheese-making, indeed, during the past ten or twelve years has not offered much inducement, or afforded much

profit, and the same may be said of butter-making; had they been otherwise, it is reasonable to suppose that both cheese and butter-factories would have become more numerous,—a result, indeed, that would have been expedited if the milk-trade had been relatively less profitable. The milk-trade has suffered in these latter years, and prices have been cut down. It is considered desirable that the trade should be worked in connection with factories, which, like governors on an engine, will regulate it; and so it is that an increase in the number of factories is likely to be made.

The system of cheese-making employed in factories is the Cheddar, with various modifications. The suppliers commonly send their milk twice a day to the factory, save perhaps in the late autumn months. At the factory it is properly cooled, and gently agitated, through the night, which as a rule could not be done at the farms. The object of the agitation is to prevent the cream rising, and it is performed by means of floating rakes attached to a small water-wheel, which give them an intermittent motion. The suppliers are bound by a set of rules which enjoin strict cleanliness, because one delinquent may spoil the milk of all. Samples of each supplier's milk are frequently taken for comparison, in order to discourage skimming,—a fault to which some persons appear to be constitutionally subject. The morning's milk is weighed, like the evening's, when received, and the two are mixed together, after which the whole mass, if necessary, is warmed up to about  $78^{\circ}$  to  $82^{\circ}$ , according to the time of the year; the warmer the weather, the lower the temperature of the milk must be, and *vice versa*. Coagulation occurs in an hour, when the curd is slowly and carefully cut by a many-bladed knife (see Fig. 14), after

which it rests for a time. It is next turned about, and the cutter again used, until the pieces of curd are about as small as raisins, after which it again rests a time for the whey to separate. Steam is then turned into the space between the outer and inner shells of the milk-vat, and the mass is kept in motion in order to prevent any particles of curd becoming scorched at the bottom, where the heat is greatest. When the temperature has risen ten degrees or so, the mass again rests, and the steam meantime is turned off, until, lastly, the temperature is raised up to about 96°. When a shimmer on the surface of the whey denotes the evolution of acidity,—and this is a point that needs most careful watching,—the whey is at once run off through a syphon, and the curd is kept warm until sufficiently acid to be put through the mill, salted, and vatted.

ACIDITY IN CHEESE-MAKING.—It will have been noticed in the factory system of cheese-making, as in the Cheddar system, of which it is an adaptation, that the development of acidity is a salient feature,—indeed, the most salient feature. This development, in fact, and its subsequent control, supplies the chief reason why the Cheddar system is found to answer well in any country. Acidity, indeed, is a necessary element in all systems, but in no other is it so consciously, regularly, and intentionally developed,—and hence, probably, the reason why the rest are not so cosmopolitan in adaptiveness, and less uniform in results. The chief danger about acid is that it may easily become too pronounced. It is most useful in separating the whey from the curd, and imperfect separation of the whey is a fruitful cause of disaster in cheese-making. It also causes the curd to become compact, and prepares it for subsequent ripening as a cheese; but too

much of it will cause the cheese to be harsh and dry, brittle and "crummy," and such cheese never ripens into a mellow and buttery article of food, with the rich flavour which is so desirable. At a temperature of 95° to 100°, acid will develop rapidly,—much more so than at the lower temperatures employed in other systems than the Cheddar,—and hence the need of careful watching. During the time the whey is allowed to remain with the curd, the milk-sugar is available for the development of acidity; but when the whey is removed, the greater part of it passes away, and it is then not easy to get too much acid in the curd. In making cheese from milk that has a strong alkaline reaction, acidity is employed with advantage as a corrective, and it is also used to checkmate tainted milk; but when the milk itself is acid to begin with, as it soon will be in hot weather if not properly cooled, it must be controlled by hastening the process of cheese-making. The action of rennet is more rapid when the milk is acid, and the subsequent operations must be hastened, viz., the cutting of the curd, the removal of the whey, and the grinding and salting. With perfectly sweet milk the case is entirely different, and the process is slower in order to induce acidity,—the temperature is raised higher, the whey is longer left on, and the curd is exposed and kept warm a greater time. The hot-iron test—the curd drawing out in threads, one end of which sticks to the iron—will denote the presence of sufficient acid. Warmth and acidity are closely allied in cheese-making, for the colder the process the slower the acid is to develop, and it can hardly develop at all in a cold curd from which the whey has been early removed. Without acid, indeed, it is a tedious and prolonged process to get out the whey, and cheeses containing too much whey are

liable to fermentation, which causes them to bulge and swell, and ultimately to crack and exude moisture. This is commonly a trouble where cheese is made from "sweet-curd"—that is, from curd in which no acid has been developed during the making of the cheese. Acidity is valuable in the case of tainted or of alkaline milk; it greatly helps to expel the whey, it improves the compactness and texture of the cheese, and it anticipates fermentation in the made cheese, thereby preventing unshapeliness in the cheese, bulging and cracking, and the running sores of a badly made article. Acidity, indeed, like many other things in nature, is a good servant, but a bad master.

**THE RIPENING OF CHEESE.**—Even well-made cheese is often injured in the ripening by damp and badly ventilated rooms, newly built or recently plastered walls, and by a temperature that is too high or too low, or that fluctuates too much between opposite extremes. The Cheddar dairymen have arrived, after long practice and careful experiments, at the belief that the temperature of a room in which cheese is ripened should range from 70° to 75° Fahr., that this temperature should be maintained until the cheese is ripe, and that excessive dryness or dampness of the atmosphere is decidedly detrimental. The object is to secure mellowness of texture along with a sweet, clean, nutty flavour, in cheese that will keep long enough for all practical uses, after it is once fairly ripe. This is best accomplished in a room that is neither too dry nor too damp, in a temperature that does not vary more than two or three degrees above or below 70°, and in an atmosphere that is humid without being moist—warmed, for instance, when necessary, by hot-water pipes rather than a stove. In hot weather the difficulty is to

keep the room cool enough ; but the temperature may be regulated somewhat by having double walls and a ceiling, forming a space through which air may circulate ; in winter it is easily regulated by a system of hot-water pipes running round the wall near the floor. Cheese that is ripe may be kept in a cooler place, in which event the supervening decay is retarded. During the ripening, cheeses should be turned daily, at all events during the first half of the period, in order to expose both sides to the air, and to have the moisture equally distributed. The loss of weight in cheese, during ripening, varies a good deal, and will run from ten per cent. upwards ; it is greatest in the first month, at all events in warm weather, and in a too dry room. As a rule it is considerable in March and April, even in cheese which, made in the previous fall, may be said to be fairly ripe. As a matter of fact, cheese continues to lose weight as long as it is kept, though slowest last of all ; and it is therefore a good plan to sell often, rather than hold it until a good deal is ready. Slowly ripening cheese is, therefore, not the most profitable to him who produces it ; and in order that it may ripen tolerably early, the temperature of the room should be about  $70^{\circ}$ , and vary very little.

BUTTER-FACTORIES.—In cheese- as well as butter-factories, and more especially, perhaps, in the former, a plentiful supply of pure cold water is a *sine quod non*. To be able to cool the milk or cream, one or both, is a matter of the first importance in hot weather. In cheese-factories it is indispensable that the evening's milk should be cooled ; and it is equally necessary in butter-factories that the skim-milk should be cooled, for either sale or cheese-making, and the cream must needs be cooled for ripening. The equipment of a butter-factory is a costly undertaking,

and this of course is especially the case when cheese and butter both are made; but where there is a demand for the skim-milk, and it can all be sold, the cost of the equipment is reduced to the extent of the cheese-making apparatus. At present there are not many creameries in the British Islands, but they are likely to increase in number. Probably the most successful one so far established in this country is the one on Lord Vernon's estate at Sudbury. Qualities tending to the advancement of agriculture appear to be hereditary with the title, for the late Lord Vernon was one of the farmer's best friends. He, in fact, was, I believe, prepared to build a cheese-factory, in the 'teens of years ago, had he been asked to do so. At that time, however, the milk trade was rapidly expanding, and it was considered to be better worth attention than cheese-making, as no doubt it was at that period, by farmers within easy reach of a railway; and, in addition to this, the dairy arrangements at the farm-houses had been greatly improved, so that cheese could be made at home, with facilities and advantages not by any means general in the district, by farmers who did not at that early period of cheese-factories welcome the innovation. The milk trade, however, after a time became less attractive as a source of profit, and home cheese-making grew out of favour, so that the present Lord Vernon had the opportunity that was denied to his father of supplying the neighbourhood with an associated dairy.

The creamery provided by his Lordship for the benefit of his tenantry and neighbours is the foremost of its kind in this country, equipped with modern appliances, for both butter- and cheese-making, the latter from full-milk as well as from skim-milk. It was opened as a Dairy

School, on August 15th, 1884, a large and influential company being present to lend importance to, and to denote sympathy with, the object. The late Mr. H. M. Jenkins read the opening address, a most interesting and appropriate paper, which was followed by a discussion in which various prominent authorities took part. Among Mr. Jenkins' remarks were the following: "The most obvious suggestion is that dairy farmers and the managers of dairy factories should take working pupils, and in support of this idea I will just point to the success of the dairy schools in Ireland, not only in obtaining pupils, but also in contributing to their welfare in after-life. These schools, however, are subsidized by the State, and it may be that pupils cannot afford to pay a dairy farmer a sufficient sum to compensate him for instruction and supervision. I would appeal, therefore, to the noble owners, the presidents, and the managers of dairy factories, not only in the business sense which I have just indicated, but also in a patriotic sense. They possess a great means of improving the dairy industry of the country by allowing their factories to be used for educational and experimental purposes." Lord Vernon met this appeal in a manner which deserved a far better response than has been hitherto accorded by those for whom the appeal was made.

Meanwhile the butter produced at the Sudbury establishment is of a superior class, and has commanded a ready sale, at high prices, in hotels and other considerable places where the consumption is large, and where price is a consideration quite subordinate to uniformity and superiority of quality. There appears to be a growing tendency in favour of both butter- and cheese-factories, chiefly perhaps in connection with the milk trade, to

which they adapt themselves conveniently. They are calculated, indeed, to work well with the traffic in country milk, as centres to which the milk can be brought, and from which it may be despatched in just the quantity required, the balance, if any, being used in either butter- or cheese-making. One of their chief advantages lies in the production of cheese and butter uniform in character, on which customers can rely. So far as butter-making is concerned, a large quantity of milk can be dealt with by the aid of cream-separators, with the fewest possible hands; the cream may be sold, if required, or otherwise made into butter, and an establishment of this kind may cultivate a trade which is beyond the reach of farmers individually. On the other hand, the milk not required by the trade may be turned into cheese, if desirable, and in this way a surplus can be utilized with the least possible loss.

Herewith I give an illustration of the ground and platform plan of a butter-factory, as suggested by Mr. Bradford, the well-known dairy engineer. It may serve as a guide to those who wish to establish an institution of this kind. The arrangement of the building and of its equipments will, however, be varied to suit the slope of the land, or the situation in reference to anything else, or as a matter of taste. A hill-side lends itself conveniently to the unloading of milk on the first floor, or even on the second, whence it is easily conveyed to the separators, and again from the separators to the floor below, where the cream is set away and afterwards churned, and where the skim-milk is cooled for despatch by rail, or else made into cheese. Cream ripened after separation churns the better, and yields butter whose flavour is developed. Skim-milk is usually sold at about fourpence per gallon.

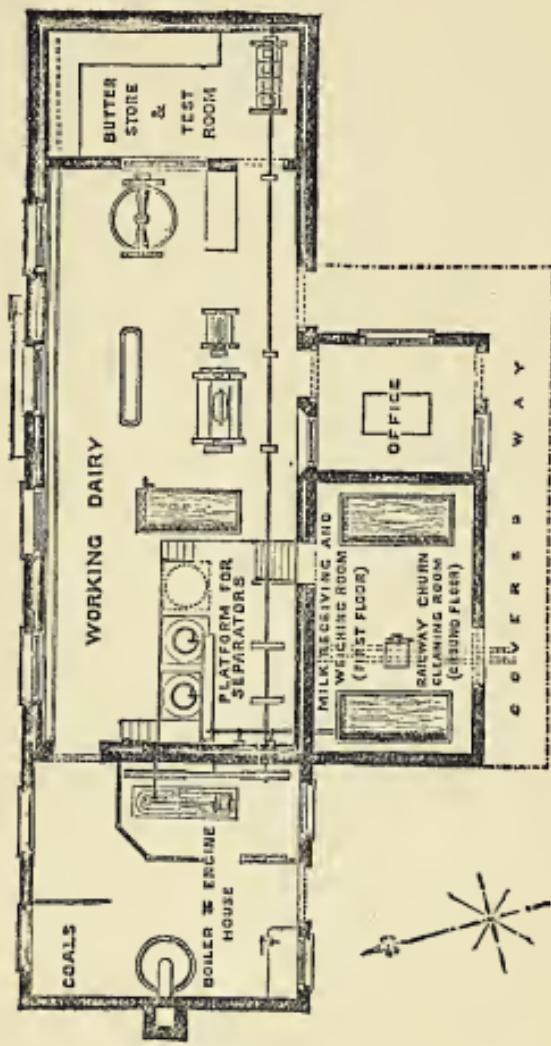


FIG. 17.—BRADFORD'S PLAN OF STEAM POWER BUTTER-FACTORY.

and at this price it may be regarded favourably as an article of food. The best plan with skim-milk is to sell it where and when there is a demand for it ; failing this, it is made into cheese, but the product is sorry stuff as a rule, and sells at a low price. Attempts have been made to make skim-milk cheese, simulating full-milk cheese, by the aid of an emulsion of lard or other kind of fat, the object being, of course, to deceive the public. Such practices can only be regarded with dislike by those who wish well to dairying, for they bring discredit upon the industry at large. A great deal of such bogus cheese has been produced in America, to the disparagement of the genuine article, and to the hurt of American dairy farmers. The loss of reputation which it has caused to American cheese in British markets is a serious matter, and the fiscal loss must have been enormous. This is an example which, I hope, will not be followed in Great Britain any farther than it has been already, and I should like to see the "Margarine" Act of 1887 amended so as to include margarine cheese. This would be a protection against fraud to which dairy farmers, as well as the public, are entitled.

The term "Butter-factory" is understood to denote an establishment where butter is made from milk sent by neighbouring farmers, as distinguished from a "Creamery," to which only cream is forwarded. Both, however, are butter-factories, for butter is produced in both. In Ireland there are a few creameries ; in America a great many. The term "dairy factory" does not appear to make any distinction between butter- and cheese-factories, being equally applicable to both.

## THE VILLA DAIRY.

A CHEERFUL suburban or country villa, with a miniature farm attached, is a very attractive residence. It forms an ideal home for the tired man of business who has a taste in that direction, for the lawyer who is weary of his monotonous parchments, for professional and commercial men generally, for those who have retired from the wearing toil of business, and for the man of means and leisure,—for anybody and everybody, in fact, who likes to dabble a little in the natural occupation of mankind and can afford to do so. To lovers of animals, as most of us are, a cow or two, a pony or a cob, a few pigs, and fowls *ad lib.* are almost indispensable accessories to a perfect retreat, "far from the madding crowd"; and it is needless to say that a select agricultural library, small though it may be, will provide both entertainment and profit.

Villa dairying is indulged in for pleasure rather than profit; but when a profit can be shown, the pleasure is doubled; for profit is a proof of management, and amateurs delight in making a profit. The pleasure, indeed, is in itself a profit, and may be very properly entered on the balance-sheet to the credit of the farmer. Farming for profit is, now-a-days, less commonly met with than it used to be; yet villa farming ought to be almost as profitable as ever it was,—in milk, and cream, and butter from the cow, in pork and bacon fed on the premises, in eggs and poultry, in vegetables of one's own raising, and in the delight which these things confer on everybody. While

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men trained from their cradles can hardly make farming pay even a little, as a business of life, and on a scale commensurate with the object, villa farming must be looked on with indulgence if its products come in a trifle below retail market prices, and with toleration if they come in a trifle above them. For, after all, they are better than those that are bought, pure at all events, and fresh,—or, to say the least, villa farmers believe they are, and this amounts to about the same thing. Therefore they are still cheaper, though they cost a little more, and everybody is satisfied while the place goes smoothly. The "paying point" in villa dairying is obviously in a different place from that in farming as a business, and certain crediting and debiting must be done to find it. In point of fact, villa dairying is primarily a pleasure, an interest in life apart from other duties, providing wholesome relaxation, filling up happily many an otherwise tedious hour, a means of occupation any time and of pride ever, physically healthy and morally invigorating, particularly when there are half a dozen or half a score cows in the herd.

A small villa dairy farm of this sort, in perfect order,—a Schweizerei, as our German friends would prettily term it,—is always a place of interest, and commonly of admiration. It may well be made almost idyllic in pastoral beauty and in pleasant surroundings! A well-ordered and productive garden, a pasture in good condition, with trees and hedges for shade, and two or three snug little meadows, supplemented by neat and convenient premises,—cow-house, stable, hay-barn, piggery, fowl-house, and so on,—with a villa residence in front of them, form the ideal home which is an Englishman's castle and domain,—particularly when he is both owner and occupier. There are many

such homes in this favoured land of ours, and the number is increasing. Dairy-farming, indeed, is more popular by far than it formerly was—more so than any other sort—and it looks well in miniature. “If mankind should ever return to the worship of animals,” said Charles Dickens, “the Cow would be the chief Divinity”! This is a high compliment to the cow,—the highest ever paid to her.

Three breeds of cows—nay, four or five, or even six—native to the British Islands, are specially adapted to villa dairying. The Jersey, the most elegant of the bovine species; the Ayrshire, one of the hardiest; the Kerry, one of the most docile,—these three may perhaps be placed first in the list, closely followed by the Guernsey, the Devon, and the Norfolk Polled. The Jersey of course is the choice one of the lot, and yields the richest milk of all, but she is not suitable to a cold climate. The Ayrshire will do well anywhere, and so will the Kerry; and these three are at once the smallest of our breeds, and the best milkers for the size of them. The other three are excellent in their way, and almost equally suitable. The last named of the six, the hornless Pollie of Norfolk and Suffolk, is the most harmless of all, save perhaps the gentle little Kerry, just because she has no osseous excrescences to do mischief with. Cows can do a lot of mischief with their horns, when they are so inclined,—and it must be confessed they often are,—to hedges, banks of earth, etc.; therefore when a cow has no horns, she is deprived of the mischief-working tools, and, lacking the ability, the desire appears to be absent. A hornless cow seems odd at first, but one soon becomes accustomed to her, and to prefer her as she is. It seems to me that all cows, and more especially all bulls, would be far better without horns, which are worse than useless in domesti-

cation. Consequently the Norfolk Pollie may be recommended to the villa farmer, and as she is a deep red in colour, she is rather a striking object to the eye. But, after all, the Jersey, a neutral tint in colour, elegant almost as a fawn, is more park-like in character, and essentially ornamental in the grounds of a villa.

It often happens at a villa that a man-of-all-work looks after the cow, the pony, the pigs, the fowls, and the garden, with help when he needs it. That he should be a good milker is most important, for an inferior milker soon makes a cow to "go dry," or to give very little milk. Where one or two cows are kept, and carefully looked after, it is surprising the quantity of milk they will give. They seem to do better, individually, than when a number are kept. This is probably because they are quieter, and this is in keeping with the tastes of a ruminant and contemplative animal; and also because they are, as a rule, more carefully fed and tended. It should always be borne in mind that wherever dairy cows are kept at all, be they few or many, they should be cared for by persons who understand them, and will take pains. My belief is that cows in milk should be groomed like a horse, in winter, though less of it will do. The gentle titillation of brushing her skin gives pleasure to a cow, keeps her clean and in good temper, warms her, and saves her the exertion of licking. The udder should be carefully rubbed with a rough cloth before she is milked, all the year round, specially in winter; the object is to remove dust or mud, and to freshen the skin. Feeding in winter should be regular, giving her just as much as she will eat up cleanly, with a relish; an over-fed cow will become fastidious, and yield less milk. Under-feeding is a cruelty; over-feeding a fault; and either of them does

harm to the cow, and causes loss. The use of silage will depend on circumstances; properly made it is a good thing, if used in moderation; too much of it will injure the flavour of the milk. It should be mixed with hay, whether chaffed or not, and a handful or two of maize and bean meal scattered into it. Hay used alone may be damped, to soften the fibre, and to cause the meal to adhere; if chaffed, it will always be moistened. A cow should always receive two feeds of unchaffed hay per day, in winter, to assist in rumination. Where roots are used, it is best to pulp them, and mix them with chaffed hay, the mass lying a few hours to soften. In this way the food is prepared for the stomach, and the labour of digestion is diminished. As a matter of fact and economy, the food given to dairy cows should be in an easily digestible condition, soft and succulent, as grass is. A considerable portion of the food is required to sustain the functions of life, of which digestion is the fundamental and most important one; therefore, if the food be prepared for digestion—and this is the most valuable feature in silage—less of it is needed to produce a given quantity and quality of milk, because less is required to make up for the energy employed in the process of digestion. It may be mentioned, too, that shelter from cold and rain stands in the place of a given quantity of food, which will otherwise be consumed in maintaining the heat of the animal system.

The utensils required in a villa dairy are very few, where only one cow is kept. By reference to Fig. 1, page 63, the best sort of open pans will be seen, on a most convenient stand. Or if cream is wanted from a small quantity of milk, in a few hours' time, the "Speed-well" cream raiser may be employed, Fig. 3. It is

claimed for this new device that it will raise cream in two to four hours, whereas twenty-four hours are needed in the open-pan system. The cream will generally accumulate for a few days, until there is enough of it to churn, or till butter is wanted; it should be kept in a cool room,

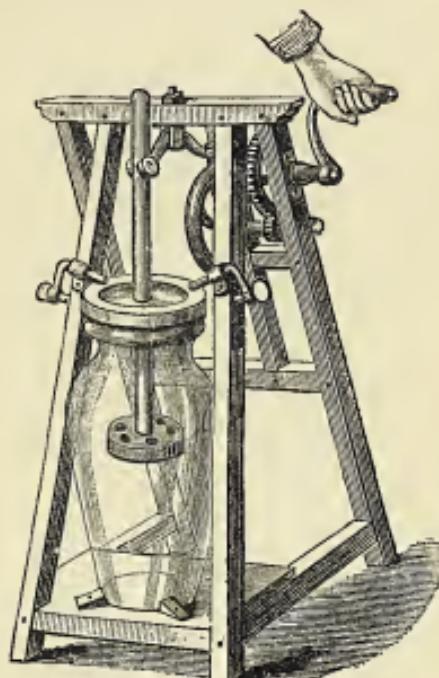


FIG. 18.—BARTHAM'S "LADIES' CHURN."

in a glazed crock, and away from odours which are liable to taint it. The room in which the milk is kept will, if cool enough, do for the cream as well. It will hardly be necessary, I imagine, in reference to a villa dairy, to again lay stress on the need there is for scrupulous cleanliness wherever milk is concerned.

There are churns without number, and I have given in Fig. 8, page 77, an illustration of one of the latest and most excellent of all. There is, however, yet another one, also quite modern, and especially appropriate to a villa dairy; this one is seen in Fig. 18, and bears the winning name of "The Ladies' Churn." It is claimed for this churn that butter is produced in it in seven minutes, and, as the barrel is of glass, the process can be watched throughout. Glass, indeed, but for its brittleness, is one of the best possible materials for the vessels used in butter-making, because it is easily kept clean. Employed as the material for the barrel of a diminutive churn, it is, for the reasons stated, highly attractive; and, to be used with care, may be cordially recommended. The various other items of equipment for a butter dairy will be found elsewhere in this volume, and it may be said that a villa dairy would hardly deserve the name if not supplied with the best and neatest, of which there is ample choice in these recent days.

## THE MILK TRADE.

FOR the following remarks on the milk trade of London, I am indebted to Mr. Barham, Managing Director of the well-known Dairy Supply Co., Ltd., Museum St., W.C., than whom a more competent authority cannot be found:—

"The provisioning of greater London with its five million inhabitants is a gigantic task. People who have their milk regularly on their breakfast-tables at a given hour little know the trouble and thought involved in placing it there. It is not so many years since the whole of the London milk supply was produced within or in the immediate neighbourhood of the metropolis, but at the present day at least nine-tenths of the milk supplied to London consumers is brought considerable distances, in some cases 150 miles, and during the scarcity of the past winter milk has been brought from Scotland and from Holland. In fact, as regards distance, it is not easy to set a limit, if the milk is sufficiently refrigerated before it is sent off. The evening's meal must be delivered in London before four o'clock the following morning, and the morning's meal before one o'clock midday. This is the only limit, and it is absolutely necessary if the London dairyman is to deliver really 'new' milk in time for the consumers' breakfast and tea.

"Forty-two million gallons is probably a very moderate estimate of the quantity of milk consumed in London yearly. Of this the Great Western Railway carries

some nine million gallons, the Midland some seven million gallons, the Great Northern three million gallons, the South Western six million gallons, the North Western seven million gallons, the Great Eastern three million gallons, and the southern lines bring us some two million gallons, while the milk produced in London and the immediate neighbourhood is about 4,000,000 gallons; for it may surprise some readers to learn that even now there are some 10,000 cows kept within the metropolitan radius in 1,100 sheds by 895 cow-keepers. Estimating each cow's produce at 500 gallons per annum, it requires 84,000 cows to supply London with milk, and, allowing an average of twenty-eight cows to each farm, 3,000 farmers are enriched by this business, and allotting ten cows to each milker it needs nine battalions of 1000 men for this task alone.

"Two thousand five hundred horses are required in conveying the milk from the farms to the country railway stations, to say nothing of those engaged in carting forage and cropping the land.

"The sources of supply are chiefly Derbyshire, Staffordshire, Leicestershire, Warwickshire, Wilts, Berks, Oxfordshire, Bucks, Essex, and Hampshire. Probably the best is that from Derbyshire and the adjoining district, Buckinghamshire and Oxfordshire.

"Some people think that they are indebted to the railways for their supply of country milk. This is a mistake. The milk must still have been produced in the immediate neighbourhood of London, had not the method of reducing the temperature of the milk by means of the refrigerator been discovered. Even so recently as the cattle plague, the importance of the milk's being thoroughly cooled was so little understood that the milk had to be drawn

from the railway station immediately it arrived and boiled to 'save its life' before it could be delivered to the consumer.

"It may be imagined that with the delivery of the milk at the railway station all trouble in connection with it ceases. This is not the case, for the trouble has only commenced. The London dairyman has to meet the trains at the London termini, where the milk must be carefully sampled and tested for its quality, sweetness, and keeping properties, and the whole of the residents in the many thousands of miles of streets in London must be supplied in time for breakfast. Unlike the butcher, the baker, and the grocer, who have the whole twelve hours' working day, or nearly the whole of it, in which to deliver their goods, the dairyman must have a sufficient staff at his disposal to enable him to cover the whole of London in little more than two hours; and, unlike the postman's, his is not a house-to-house service or a monopoly of certain defined districts, but his customers have had a free choice amongst the 12,000 shops selling milk, and may live several hundreds of yards, or it may be half a mile, apart.

"There are probably no fewer than 4,000 horses engaged in the delivery of milk in London, and more people are employed in this than in milking the cows. Agriculturists often wonder at the difference in the price paid to the farmer and that charged to the consumer; a little thought, however, will enable them to see that it costs as much, and probably considerably more, to handle and deliver the milk than it does to produce it, inasmuch as the wages paid by the London dairyman to his men, whose duties frequently begin at 4 a.m. and are not ended until 7 p.m., Sundays and weekdays, must be a good deal higher

than the wages paid to the milkers on the farms. Moreover, the rent that the London dairyman has to pay for his dairy is frequently considerably in excess of that of the farm on which the milk is produced. I have a place in my mind now where a rental of £300 per annum is paid for a moderate ground floor and basement. In addition to these the cost of the horses is a very considerable item as compared with the farmer's expenditure on this head. In London each horse cannot be estimated to cost less than £1 per week, which of course includes bedding, provender, shoeing, rent, veterinary, etc.

"Perhaps one of the most noteworthy features of the age in which we live is the tendency of expenditure to increase, and in no trade has this been more marked than in that of the town dairyman. The Adulteration Acts necessitated the establishment and maintenance of a scientific staff, lest through some fraud or neglect of the farmer or his servants a valuable business might be ruined, and the reputation of a lifetime lost by the sale of milk of an inferior quality. During the past year some 20,000 samples were analysed by one company alone. This involves also a large number of foremen and inspectors to look after the men on the dairy premises, and the carriers employed in the delivery of the milk. Moreover, in the matter of carriers alone the expenditure in twenty-five years has increased some 200 per cent. Twenty-five years ago more than three-fourths of the milk was delivered by women—most of whom were Irish, but some few were Welsh. They were clean, healthy, powerful women, and indeed they needed to be, for many carried 1½ cwt. of milk suspended in pails from their shoulders. Now-a-days, to see a woman engaged in this occupation is comparatively rare; men do nearly all the work of

delivery, and for that purpose must have perambulators, as they are called, and the milk is placed upon wheels and pushed along. Any one can do for this, but formerly strong, healthy country fellows had to be selected, who could stand under and walk away with some 2 cwt. of milk. The women I have referred to used to be paid 9s. a week wages. Now-a-days the men are not overpaid at from 23s. to 25s. weekly, and the service is certainly not better done than in the old days. It is surprising, as I have remarked on more than one occasion, that while the vaunted penny post charges a penny for the delivery of a letter weighing 1 oz.—the writer finding the materials, and the average distance each letter is conveyed not exceeding that over which country milk is carried, and the postman enjoying the monopoly of a house-to-house delivery in well-defined areas at his own time—the dairyman delivers some 9 ozs. of milk for the same sum, whilst paying the farmer for the production, the railway carriage, and the staff such as I have described it, such delivery being spread all over the metropolis, and, moreover, small cans having to be provided by the dairyman in addition to the railway churns, as well as thoroughly washed and cleansed.

"One of the great difficulties with which the London dairyman has to contend, and a cause of the greatest anxiety to him, is the rise and fall of the thermometer. Few people are aware that ten degrees one way or the other may diminish or increase the supply in an inverse ratio to the demand. Thus, in seasons of extreme cold, the cows shrink their milk, while from the same cause the Londoner is demanding an extra cup of coffee or basin of arrowroot or of bread and milk. Again, during seasons of great heat, which has precisely the same effect

on the cows' production as extreme cold, the customer demands an increased quantity for his family needs. Ten degrees lower temperature in the summer will create a lessened demand and an increased supply, to such an extent that one firm has been known to have had returned by its carriers some 600 gallons in one day. It will thus be readily seen that constant application and attention is required to avoid the great loss which would otherwise be incurred, and to enable a business of this kind to be carried on with advantage. Without these elements, in fact, and without the hand being, so to speak, constantly on the tiller, no town dairy can be properly managed.

"Cream-separators have been found of immense assistance. To make cheese in London in large quantities and at uncertain intervals has been found to be impracticable, while to set for cream such quantities of milk as I have named is almost equally so. But now a considerable portion of what would otherwise have been lost is saved by passing the milk through separators, and churning the cream into butter.

"Probably no town in the world is so well supplied with milk as London. Although the consumption per head is much greater in Paris, it is surprising that the consumer there is content to have the milk delivered once daily and then twenty-four hours old, one meal being boiled and mixed with the next, and sent into Paris in the night-time; while in London it is delivered fresh twice daily in a very short time after it is drawn from the cows."

## TRANSIT OF MILK BY RAIL.

THE Council of the British Dairy Farmers' Association have made the following suggestions in reference to the rates which they consider ought to be charged on all our railways for carriage of milk by passenger trains; they are made with the object of removing the anomalies that are at present in force, and of having a uniform system established :—

### " NEW MILK.—

			per Imp. Gallon.
For any distance not exceeding	30 miles	$\frac{1}{2}d.$	minimum 6d.
Above 30 miles and	" 75 "	$\frac{1}{2}d.$	" 9d.
" 75 "	" 150 "	1d.	" 1/-
" 150 "		$1\frac{1}{2}d.$	" 1/3

The Company should be liable for delay, damage, or loss, whether wilful or not. No extra charge to be made for weight of Cans.

The Empty Cans to be returned free of Charge at owners' risk, and no charge to be made for labourage as at present in force on one line, or for station or service terminals.

CREAM (being of more value than New Milk); double rates to New Milk.

SEPARATED MILK (being of less value than New Milk); half the rate charged for New Milk.

If no distinction is made by the Companies between the rates for Separated and New Milk, then Cream should be included in the New Milk Rate."

That the rates charged by some railway companies are prejudicial to the milk trade is well known, and as the trade has already attained enormous dimensions, and will probably go on increasing, it is important that Parlia-

ment should take action in the matter of rates on produce, as it long ago did in reference to passengers. Failing such legislative step, it is idle to expect that the Companies themselves will act in concert and, with due regard to the interests of their customers, establish the rates on a basis that would be at once simple, uniform, and satisfactory. Some of the railway companies, indeed, handicap our farmers terribly by charging excessive rates; surely this is not the way to cultivate traffic, the very object for which railways exist.

It would be a good thing, too, if the Companies' servants would take a little care of milk cans, especially empty ones. Full ones they cannot tumble about in the reckless manner they do empty ones, or the milk would be spilt and damages claimed. Empty cans are, however, fair game, and are knocked about like nine-pins. Some of the railroad officials in America are known under the generic name of "baggage-smashers," because of the morbid prurienty they have for injuring passengers' trunks. This order of the *genus homo* does not appear to be confined to the other side of the Atlantic.

## AILMENTS OF DAIRY STOCK.

SCOUR, OR "GURR."—Occurring generally in the first week or two, this is the earliest contagious malady to which bovine quadrupeds are liable. Its cause is commonly indigestion, brought on by improper feeding; or a chill, caught in a damp or draughty calf-house; or nausea, caused by foul air; or it may be owing to natural debility of constitution. As prevention is better than cure, the calf-house should be so constructed as to be dry, clean, not too warm, and well ventilated without draughts; and the calves should receive from one to four pints of fresh milk three or four times a day, for the first week or ten days. Only very big and vigorous calves should get as much as four pints at a time. To cure the malady, which is frequently fatal if proper means to check it are not taken, a dose of castor oil, with thirty to forty drops of laudanum added, should be given. If the pain and flatulency continue, three or four doses daily should be given of forty to sixty drops each of laudanum and sulphuric ether, in a little water. Or else two or three doses in the day of aromatic balsam oil, in each of which an egg has been well beaten,—from one to two wine-glassfuls of the oil forming a dose. This may be followed each day by a tablespoonful of chalk mixture in skim-milk, or flour gruel, and the calf should be fed sparingly.

HUSK, OR HOOSE.—This malady is owing to the presence in the windpipe and some of the bronchial tubes of a large number of parasitic worms, *Bronchial filaria*.

which are derived from stagnant water or rough herbage. These parasites cause irritation in the throat,—hence the frequent hacking cough which denotes their presence,—and this is followed by short, quick breathing, loss of appetite and of flesh, and diarrhoea. It occurs generally in the autumn, when there are heavy dews on the grass, and may, as a rule, be prevented by housing the calves o' nights in a dry shed or yard, and not turning them out in the morning until the dew is off the grass. Strong, well-fed calves resist the invasion far better than weakly ones,—which indeed should go without saying,—and a generous diet of dry food is therefore a preventive. I have cured the malady by pouring a teaspoonful of a mixture of spirit of turpentine and olive oil down each of the upturned nostrils of a calf. It is better, however, to use Day & Sons' "Huskolcin," which is less instant in action, but less rough on the calves. It may also be cured by burning sulphur on a shovel of live cinders, inside a closed shed, and causing the calves to inhale the fumes which arise.

**BLACKLEG, SPEED, OR HYANT.**—This too is a malady—not at all communicable as the preceding ones on occasion become—which, in some localities, calves are peculiarly liable to, in their first autumn and winter, and it sometimes attacks yearlings and twinters. It is owing to the blood becoming charged with deleterious matter, and occurs from changes of food, from an excess of albuminoids in the food—as in decorticated cotton cake—and when the wane of the year comes on. A calf becomes dull, and is no longer with its companions; it stands alone under a wall or a hedge, and is disinclined to move at all; you go up to it, and it moves not away, does not even take any notice of you; this calf has been seized with "speed," and you

may as well kill it out of its misery, for it will almost certainly die in the course of the next twelve hours. The best way to prevent the malady is to keep the calves in a steadily but not rapidly thriving condition, and to avoid giving them food that has too large a proportion of albuminoids. My own impression is that, in their first winter, calves should run loose either in a yard with sheds round it, or on sound, sheltered land, with a shd under which they may be fed and may run for shelter from storms. The "steadily thriving" condition should be from their birth up, and linseed cake should be given to them, and occasionally a little salt, until they go out to their second summer's grass (see p. 35 *et seq.*). One ounce of sulphite of soda twice a week is said to be a good preventive; but it is probable that careful dieting is the best of all. Some localities enjoy an enviable immunity from this scourge, owing probably to some beneficent property in the soil or water.

Some farmers put a seton into the dewlap, considering it serviceable as a preventive of speed. Possibly it is, in many cases; but I have known setoned calves to die of speed.

**RINGWORM.**—This cutaneous disease, owing to a cryptogamic parasite, is unsightly enough, but not fatal. It is chiefly among young stock, and is decidedly infectious, but easily cured by a dressing or two of chloride of zinc ointment, or a solution of corrosive sublimate. There are also preparations for the cure of it, which may be had from our leading veterinarians.

**LICE.**—These parasites are generally found on cattle out of condition, dirty, and so on, that are kept in sheds in the vicinity of fowl-houses. Tobacco-juice, mercurial ointment, or solutions of corrosive sublimate will kill

them ; and I can testify to the efficacy of McDougall's "dip," which, at one dressing, destroys the lice, and enables the animal to begin thriving once more.

**ABORTION IN COWS.**—This appears sometimes to be a contagious malady, where cows are housed together in one shed ; for when one begins most of the others may follow. Whether or no it is communicable from one cow to another, by inhalation of germs thrown off in the breath or exhalations of an affected animal, or by nervous sympathy, is, however, not proven with certainty, though it is probably the case, and the ailing beast should at once be isolated from the rest. It may occur individually as the result of an accident, from the fatigue of a long journey, or the jolting of a train, or the excitement caused by sudden fright, or from being chased by dogs or flies. Much more commonly than most men think, however, it comes from the eating of ergoted grasses, for which some cows seem to have a morbid appetite. On swampy land, or in ditches, may commonly be found growing the tall seed-stems of grasses, the seed of which, being examined, is seen to be enlarged and blackened with the disease called ergot, which is a common cause of abortion. The dairy farmer, as the autumn comes on, should examine the tall grasses on the damp land or in the ditches and hedge-rows of his farm ; and if he finds any symptoms of ergot, should at once have all such grasses cut and burnt. A safer plan would be to have them cut down late in the summer, whether there be ergot on them or not.

In-calf cows should be kept quiet, if possible, free from the chasing caused by gad-flies or dogs. As a matter of fact, dogs do far more harm than good where breeding animals are kept. A shrewd dairy farmer I knew years ago—he was a large sheep farmer too—would not allow

a dog to be kept on his farm ; he said he could not see that he was "any dog-work behind."

Abortion usually occurs without much warning, and the foetus, being small, is easily parted with as a rule. But the cleansing often remains for weeks attached to its uterine connections, and becomes offensive. The parts should be washed twice a day with carbolic soap, or with a weak lotion composed of carbolic acid and tepid water, which may advisedly be injected within the uterus. The foetus should be buried at once, and the cleansing too, as soon as it is at liberty, and the shed should be cleaned out and disinfected. A gallon of sour buttermilk, repeated once or twice, will commonly liberate the cleansing, or a cleansing drink may be horned into the cow. She ought to receive nourishing food, both solid and liquid, and she should be kept in a fairly warm shed which is clean and well ventilated.

PARTURITION.—Sometimes copious bleeding supervenes, in which case a piece of thick cloth, soaked in cold water, should be laid on the loins, and kept wet by pouring water frequently upon it. Ice, if available, may be put in the uterus and vagina, or otherwise a cloth soaked in cold water. When "straining" occurs, the cow should be kept quiet, soothing injections should be used, and doses of opium, chloral, and belladonna should be administered. Protrusion or inversion of the vagina sometimes occurs; it should be carefully replaced by hand, and the cow should then wear a truss until the danger of a reappearance is past.

MILK-FEVER, OR "DROP."—This fatal disease generally occurs in hot weather, and to deep-milking cows in high condition. Occasionally it comes on before parturition, but usually after it, and old cows are more subject to it.

than young ones. It may be frustrated if taken in time, but it is frequently fatal. To prevent its occurrence the cow should be kept out of the hot sun-rays, fed rather sparingly on food that is succulent and not rich, and a dose of Epsom salts should be administered at intervals of four or five days during the fortnight preceding parturition.

The symptoms of milk-fever are seen in the cow's restlessness and loss of appetite. After a time she becomes weak, lies down, and is unable to get up. The pulse and respiration are quickened, and the eyeballs protrude; later on the brain becomes affected, and the head is thrown back, resting on the horns. Lastly, paralysis ensues, soon followed by death. But the case should be taken in time, while the cow can still swallow, and a dose should be given consisting of half a pound each of common and Epsom salts, twenty drops of croton oil, two ounces of oil of turpentine, and one pound of treacle, in a quart or two of water; or one of Day's red drinks may be given, along with half a pound of Epsom salts, in warm water well sweetened with treacle. Counter-irritation should be produced by rubbing mustard paste, or ammonia liniment, down each side of the spine, and the cow should be well packed up by battens of straw, turned about two or three times a day, and her udder rubbed and the milk taken out of it. Stimulants are useful from the outset, and half a pint of whisky may be given, but no effort should be made to administer anything if she is not in a condition to swallow. As the crisis passes, the appetite will return, and food easy of digestion should be supplied. The recovery is generally rapid, once the worst point is over, and the lacteal organs resume their functions, not very much the worse for the interruption. It is understood to be a good thing with a cow liable to milk-fever

to milk her before she calves, for several days if advisable, and afterwards to draw out all the milk you can. Some persons do not allow their deep-milking cows to go dry for calving, believing that a continuous flow of milk reduces the liability to fever.

**GARGET, OR MAMMITIS**—inflammation of the udder and curdling of the milk—is caused by careless milking, by blows or crushes, by exposure to cold or wet in hot weather, by attacks of foot and mouth disease, and so on. The milk in the udder becomes stale and thick, and is a cause of irritation. The udder becomes hot and inflamed, the skin hard, shiny, and reddened, and the cow is feverish. The summer and autumn months are the most fertile of this malady, grazing cattle that have not been giving milk for several months being liable to it in the month of August. The udder contains sour, coagulated milk (which must be removed, if possible, pretty frequently), and soon becomes tender, very painful when touched, swollen, and the swelling extends beyond the limits of the udder. If the inflammation is not subdued early, the cow will generally lose one or more “quarters” of the udder, whose functions in this event are very seldom restored to their pristine vigour. When the inflammation is intense and prolonged, abscesses form and open into the teat, or, forming outwardly, either burst or require to be opened with a knife. Results still more serious occur under neglect: the udder may mortify, and acute inflammation will kill the cow.

The first remedial operation is to get all the milk possible out of the udder. When the teats are too tender, or are stopped with clots of diseased milk, a syphon must be used to draw out all it can, and the curdy matter must be got out by hand in the best way that a good man can

think of. The udder should be fomcuted with hot water for a quarter of an hour three or four times a day, and poultices of bran, or spent hops, will afford relief. The poultices must be suspended from the loins, in order that they may sit well up to the udder when the cow is standing. Between times the udder should be rubbed with ointment of belladonna, or else with purified Driffield Oils; this will reduce the inflammation, and help to break down the offending clots of curd, which must then be got out by careful hand-milking. If the udder remains hard, it should be rubbed twice a day with a dressing composed of equal parts of soap liniment, tincture of opium, and compound solution of iodine. Open abscesses must be dressed with antiseptics, and the bowels should be opened by oil and treacle, or else by Day's red drinks. The cow may be saved and the udder restored to healthy action, but not without trouble and careful nursing. The teats are sometimes choked by the diseased milk, and should be opened by inserting a teat-syphon, and a daily dose of four ounces of Epsom salts and one ounce of nitre may be given to diminish the secretion of milk for the time, and to reduce the fever.

HOVEN, OR DEWBLOWN, *Hoven tympanitis*—distension of the rumen or first stomach—arises from the greedy eating of dewy or frosted clover or grass, wet roots, or raw grain, especially wheat. The formation of gas in the rumen is caused by the fermentation of an over-feed of such things, and as it forms the rumen distends, the peristaltic action of the stomach ceases, and digestion is checked. The animal becomes much swollen, or rather distended, especially on the left side, pokes out her nose, blows and moans, and, unless relieved, will commonly die from the pressure on the heart and lungs exerted by the

abnormally distended stomach, or from rupture. Causing the cow to move about will frequently enable the gas to escape; but if not, a dose of turpentine, whisky, or carbonate of ammonia, in a pint of oil, milk, or gruel, should be poured down the throat, out of a horn; or one of Day's black drinks, in water, may be given. It is not likely that the latter will fail; but should it do so, an opening from the outside into the rumen must be made by a trocar. In this event, the animal should for a few days be fed on soft food that does not require rumination as part of the operation of digesting it. Ten drops of spirit of ammonia, in water, is said to be a certain remedy.

RED WATER, OR MUIR ILL, is peculiar to certain localities, and in others is not known at all; its causes are somewhat obscure, and may be various. The urine is a red or reddish-brown colour, and unless remedial measures are adopted, it will turn black, in which event the animal will sometimes die in spite of any treatment. Half a pound of Epsom salts, or a pint of linseed oil, along with a red drink, the last named being repeated two or three times a day until the bowels are opened, will be found beneficial, and the food of the animals should consist of bran-mashes, gruel, fresh grass, or good hay, but not of roots.

MAWBOUND arises from greedy feeding, and consists of distension of the first stomach, or rumen, as in "Hoven"; but the distension is caused by hard, undigested food, and not by the gas of food-fermentation. The cow becomes dull, and has a look of distress, in the early stages; the appetite is gone, and she no longer chews the cud; the extremities become cold, the pulse feeble, the breathing is affected, a grunt following each expiration, and eventually death is caused by suffocation, if relief comes not.

A dose of Epsom salts in a quart of warm gruel, along with one pound of treacle, will as a rule give relief; and there are remedies readily compounded, requiring only to be put into gruel, which farmers should always have at hand. One of Day and Sons' Medicine Chests contains all the medicines required for the common ailments of dairy-stock; relief may by their aid be afforded without waiting for professional assistance, and delays are commonly dangerous.

COLDS AND CHILLS oftenest occur in the spring of the year, when the weather is changeable. Cattle that have been housed all winter are more or less liable to take chills, when they are again turned out of doors, especially in cold and exposed districts; and as these chills introduce various diseases, if neglected, it is advisable not to pass them over carelessly. A stiffness of gait, and quickened pulse, and dry nose-end, are the earliest symptoms, along with general dulness and loss of appetite; and whenever these are perceived, the cow should be placed in a warm, dry, well-ventilated shed, or loose-box, rugged up, and fed with nourishing gruels. A red drink or two may be given, in warm gruel sweetened with treacle, as an aperient, and succulent, and easily digestible food should be supplied.

FOOT AND MOUTH DISEASE, or contagious eczema, has done too much mischief and is too well known to require describing. It is easily detected by lameness in the feet, and a discharge of saliva from the mouth. It was first introduced into this country fifty years ago, from the Continent, since which time we have had many attacks of it. It is not a very fatal disease, and the mischief it inflicts is less in deaths than in loss of flesh, in udders deranged; in hoofs coming off, and in general debility. Cooling and

opening medicines, and nourishing gruels, are very useful; and the mouth and feet should be well washed several times a day with dilute Condy's fluid, or some other mild astringent antiseptic lotion. To bathe the feet in cold water gives relief to the animals, and shelter from the rays of a hot sun should be afforded.

**PLEURO-PNEUMONIA**, or contagious disease of the lungs, is much more generally fatal than foot and mouth disease. Sometimes it spreads with alarming rapidity; at other times it will remain for months in abeyance, as it were, in the system, before it becomes developed. Of the animals attacked, about one-half will die, and such as live through it are seldom any good; for the lungs remain structurally imperfect, and the animal can seldom thrive. There appears to be no medicinal cure for it that is at all reliable or certain, and the policy of stamping it out by killing the animals has been adopted.

**FOUL AND THOROUGH-PIN**.—This painful disease is often caused by some foreign substance getting between the clefts of the hoof, and causing irritation. There are two kinds of foul—smelling and swelling foul. The former may be cured by cleaning out the cleft thoroughly, and applying a dressing of powdered blue vitriol and unsalted lard; the latter requires a good deal of poulticing, and an application, several times repeated, of foot-rot oils, which will also cure smelling fouls. Swelling foul often develops into thorough-pin, which requires the treatment applied to swelling foul; eventually a core like a parsnip comes out at the heel, after which the foot soon gets well. Either of these diseases, particularly thorough-pin, will cause a cow to fall off greatly in both milk and flesh.

**WARTS, OR ANGLEBERRIES**.—Cows' teats are sometimes a good deal infested with these excrescences, which inter-

fere with the milking. A strong ligature of waxed thread tied round the base of the wart, and tightened each day, will generally cause them to fall off. If, however, they are malignant, they must be cut out with a sharp knife, to wield which a skilled operator must be employed.

SORE TEATS are commonly caused by those abominations on milkers' hands, viz., long finger-nails. Dirt will also cause them. Some cows seem more subject to them than others, probably the cuticle is more tender; and some seasons, or portions of seasons, apparently bring them on more frequently than others. Many a pail of milk finds its way to the ground in consequence of sore teats, and many a cow is unmercifully pummelled as the sequel, spoilt in temper, and made a kicker. Some milkers never think of cleaning a cow's teats before they milk her, but spout milk into the palms of their hands and go on milking, working the dust and dirt into the pores of the teats, and causing sores to come. Cows should always be milked with dry hands, unless the teats are sore; in which event, a little unsalted lard, or suitable salve, may be smeared over the sores and well worked in by the hands in the process of milking. Before the lard is applied, the teats should be washed, and dried with a cloth; indeed, cows' teats should always be wiped with a cloth before milking commences, if they are at all dirty. By careful attention to cleanliness, sore teats may either be avoided or cured, without much trouble. Sometimes the teats are too sore to admit of hand-milking; and when this is the case the milk should be abstracted by means of a syphon, and the sores should be cleaned, if necessary, and smeared with glycerate of tannin.

SWOLLEN UDDERS should be well bathed or fomented with warm water, carefully dried with a cloth, and afterwards rubbed over with Day's purified Driffield Oils. They are generally caused by a cold, a bruise, or garget from poor milking ; and, if neglected, may result in the loss of a quarter. A dose or two of cooling and openin<sub>g</sub> medicine will generally aid recovery. During this time, the milk should be drawn from the swollen quarter or quarters several times a day, in order to ease the udder ; and, indeed, if left in, the milk itself soon becomes an active cause of irritation. A plaster of cow-dung is also found to be most useful in cooling and reducing hot and swollen udders.

RETENTION OF URINE does not often occur, and seldom in cows than in bulls. Fomenting the loins with warm water, and injecting it into the rectum, will commonly give relief, and a dose or two of Red Drink in gruel and treacle will be found to render valuable assistance. This treatment failing, as of course it may in obstinate cases, the only remedy left is to employ a competent person to use a catheter. There are cases, at times, in which the urine dribbles away, the animal being unable to retain it ; the causes are found in relaxation of the urethral canal, or in the urine being overcharged with something deleterious. A stimulating course of medicine should be followed, and the animal fed on nourishing gruels.

## PIGS.

In the wide disparity between the domesticated swine of to-day and the wild porcine quadrupeds from which they are descended, the art of man is perhaps as clearly to be seen as in the marked improvements which have taken place in the breeding of any other kind of the live stock of the farm. The raw-boned, ungainly denizens of the ancient forests, still found in France and Germany, though long ago extinct in Great Britain, were a crude material out of which it could hardly have been thought possible to evolve the shapely, docile porkers of to-day, which easily become almost helplessly fat. Of the many distinct breeds of pigs in this country, the smaller ones are most generally popular. The large white Yorkshires, still liked in some districts, were once in more general demand than now, because of the large weights they attained; but the enormous importations of American bacon have reduced the value of the somewhat coarser bacon which these large pigs yield, and the smaller breeds produce hams and bacon which command a better price. The small white Yorkshires, the Berkshires, and the Tamworths, being neat, compact, symmetrical, make the nicest porkers, and yield the most attractive bacon.

Pigs are well in place on dairy farms, save where the milk is sold. Where cheese or butter is made, they consume a good deal of slop that would otherwise hardly be utilized. The by-product, whey, for example, is of very little use to calves, though pigs do very well with it;

skim-milk, however, is an excellent thing for calves, and probably pays better in them than in pigs. Some farmers consider that pigs are hardly worth keeping for the consumption of the whey, and that it is more profitably given to the cows to drink. After all, the pig is the scavenger of the farm, utilizing various kinds of rough food that do not commend themselves to the taste of horses, cattle, or sheep. It may be admitted that breeding pays better than fattening, and it is the breeding sow that is the head scavenger; she eats up the coarsest food,—the whey of the dairy, the slops of the kitchen, the surplus garden-stuff, and so on, and is quite at home on turnips and potatoes, mangels, carrots, cabbages, either raw or cooked. All is fish, in fact, that comes to her net.

Breeding sows must not be pampered either in food or lodging, if they are to be prolific, nor should they be confined much in the styes. Coarse, sloppy food, with grass to graze and plenty of exercise, is the fare best suited to them, throughout the spring, summer, and autumn. They take great delight in rooting, and will do a good deal of rough summer-fallowing, it is said, if you scatter some beans among the clods. They are not good gardeners, however, and will make a terrible mess in a grass field, if they have no rings in their snouts. A pig's nose is well formed for the insertion of rings, through the ridge above the nostrils; and when young pigs are big enough to begin rooting, they should be rung before they do much mischief. Pig-rings, American pattern, may now be bought, and they are very handily inserted with the aid of nippers into which they fit.

The value of whey for pig-feeding is variously estimated. At the cheese-factories the milk suppliers are debited with it at one halfpenny a gallon. But cheese-factory whey is

poorer in caseine and fat than, as a rule, is the whey produced in home-cheesemaking, and a halfpenny a gallon is no doubt all it was ever really worth, and more than it is worth in the present day. For, after all, there is but little in such whey that has any nutritive value, save the milk-sugar. Mr. Gibbons, of Bath, the well-known Cheddar cheese-maker, formerly valued his whey at one penny per gallon; but, now that bacon is much lower in price than it used to be, he estimates its value at  $\frac{5}{8}$  of a penny per gallon, or 25s. per cow per annum, for pig-feeding purposes. It is probable that whey has some value beyond that indicated by its analysis, inasmuch as it enables other foods to be utilized, and it may perhaps have some good effect in reference to digestion generally. As a fat-producer, sweet whey is superior to sour whey; for if the sugar in it acidifies, its character is changed, and it is so far deteriorated for fattening purposes. At the same time it may be said that sweet whey too freely fed has a tendency to unduly relax the bowels, while a moderate quantity of acid whey appears to work well with corn.

There can be no doubt that skim-milk is an excellent food for pigs, whatever whey may be, even though very nearly the whole of the butter-fat may have been extracted by a separator. It is computed that 1,000 lbs. of average milk, as it comes from the cow, contains:—Caseine, 32 lbs.; butter-fat, 36 lbs.; milk-sugar, 45 lbs.; mineral matter, 7 lbs.; the rest being water. This is 12 per cent. of solids, and in butter-making, very little beyond the fat, or say  $3\frac{1}{2}$  per cent. of the total solids, is removed; whereas in cheesemaking the caseine also is removed, and a small proportion of the remaining solids. Skim-milk therefore contains practically all the caseine, or albuminous matter, which is

so valuable as a flesh-producer. In removing the butter, what is considered the most valuable constituent of milk is taken away, but the flesh and muscle and bone-forming elements remain, and skim-milk is really a more valuable article of food, either for man or beast, than it has generally the reputation of being. The best bacon possible is produced with the aid of skim-milk, and there is indeed nothing else equal to it save milk that has not been skimmed. A mixture of oat and barley meals, a little boiled linseed, and plenty of skim-milk, will produce finer pork, bacon, and hams than anything else will. While whey may be regarded as rather dear at a half-penny a gallon, some of our practical pig-feeders consider that skim-milk is worth twopence a gallon, for pig-feeding purposes.

Fattening pigs will thrive better on warm than on cold food, particularly in winter, as indeed store pigs also will, and it is a good thing to wash them once or twice a week with lukewarm water, and scrub them with a stiff brush. The pigs like this, and the benefit of it will be perceived by those who will be at the trouble. A clean dry bed, though not necessarily a soft one, is also a good thing which pigs enjoy. Fond as most of them are of wallowing in the mire, of rooting in anything and everything clean or dirty, and of putting their fore-feet into their food, still they like a clean, dry bed. Straw in cold weather is useful for the warmth it supplies, but in warm weather pigs are quite as well if not better without it. If they have boards to lie on, they will usually keep one corner clean for the purpose; and as their bones are so well covered with flesh, they do not need straw for its softness. As a matter of fact, they will generally have cleaner beds without straw than with it, unless it is frequently

changed, and straw can usually be put to a more profitable purpose than as litter for pigs.

Pig-styes should be roomy, weather-proof, and warm. It is as well that the yards should be roofed in, to preserve the manure from the rain, with an open yard adjoining for the exercise which breeding sows and store pigs ought always to have when they want it. The breeding-stye should be littered with straw a few inches long, and a strong, round rail of wood should run round the place, a foot from the wall and the same distance above the floor. The rail is to allow the young pigs to avoid being crushed against the wall when the sow lies down, which she generally does in a most careless, lazy, and lumbering fashion, quite regardless of where her young ones may happen to be. Young pigs should have plenty of dry, clean straw in which they may huddle close together for warmth; and when they are weaned, at about two months old, they require warm food, say of skim-milk, with a little meal in it, and the sty should be kept clean. Later on, they may go out on the grass, small rings having been put into their snouts to prevent rooting; or they may have a small paddock, in which it does not matter much whether they root or not. This last, perhaps, is preferable, though very untidy, for pigs seem to thrive on the exercise of rooting.

In breeding for sale, which is generally more profitable than fattening, it is advisable to get hold of good specimens of pure breeds, improving them, and keeping them pure, and avoiding too close in-breeding. Some men have a special aptitude in this direction, and make a good deal of money out of it; but it may be doubted if very much wealth is made out of the fattening of pigs for the market in England.

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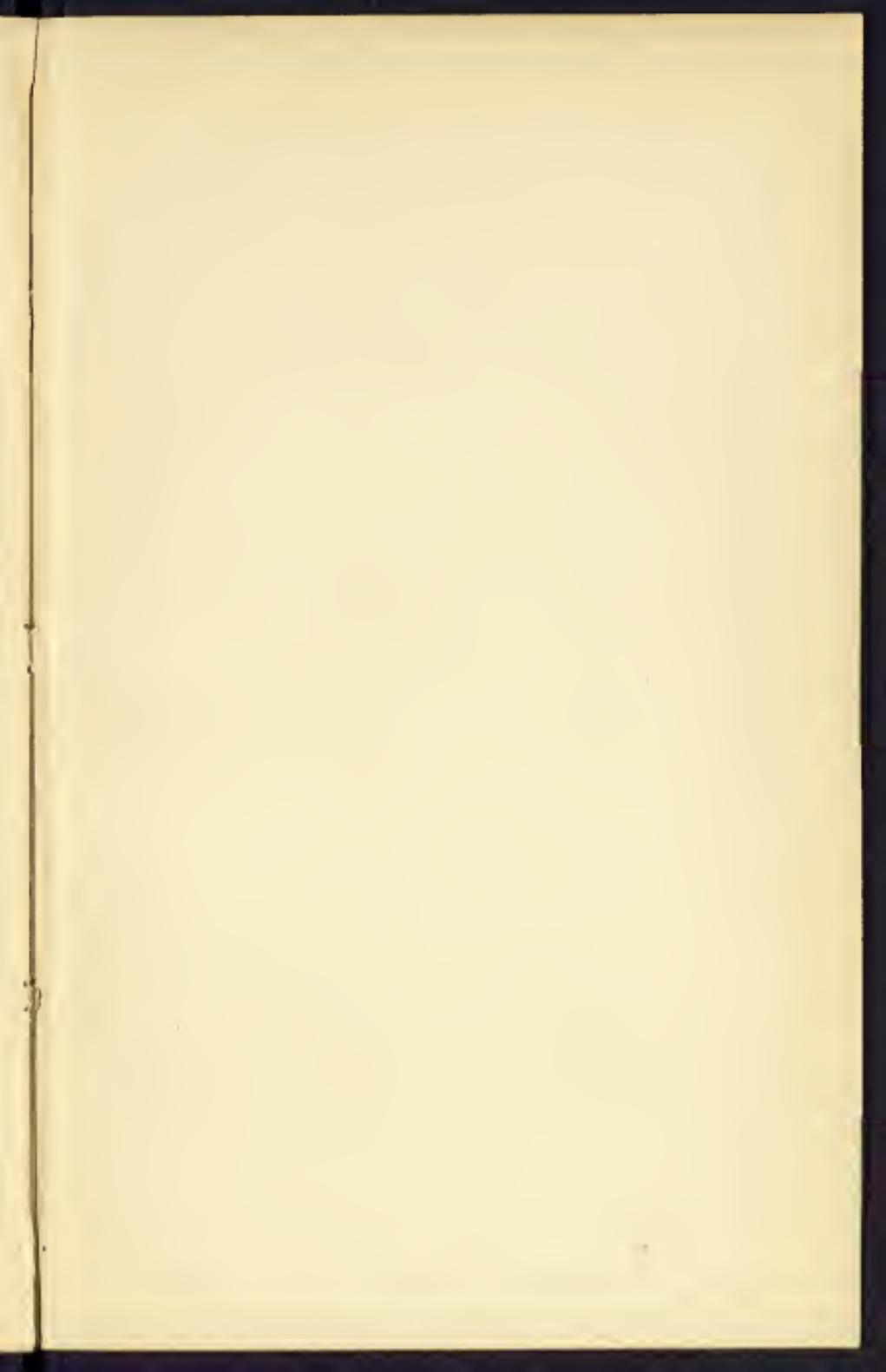
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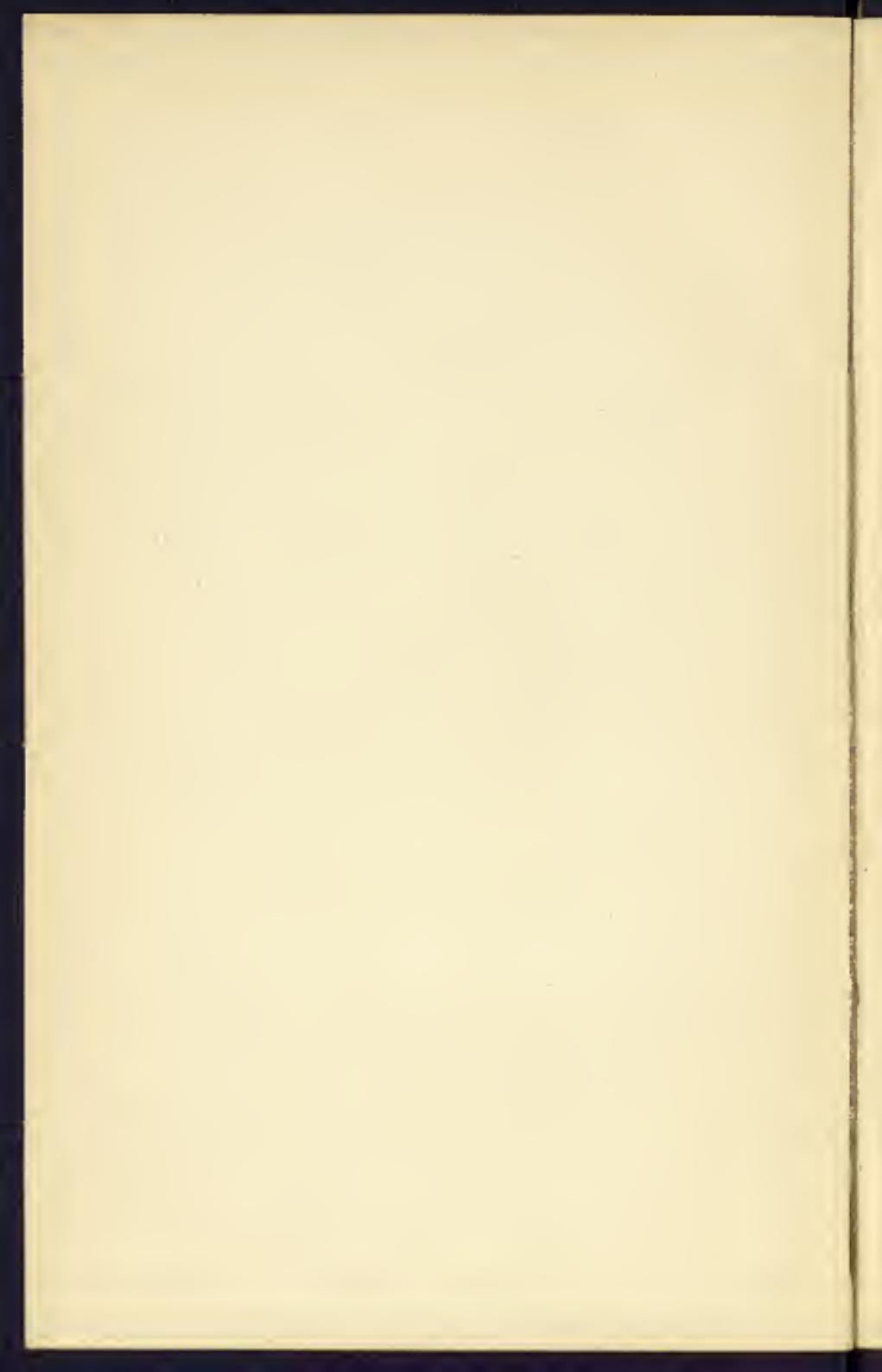
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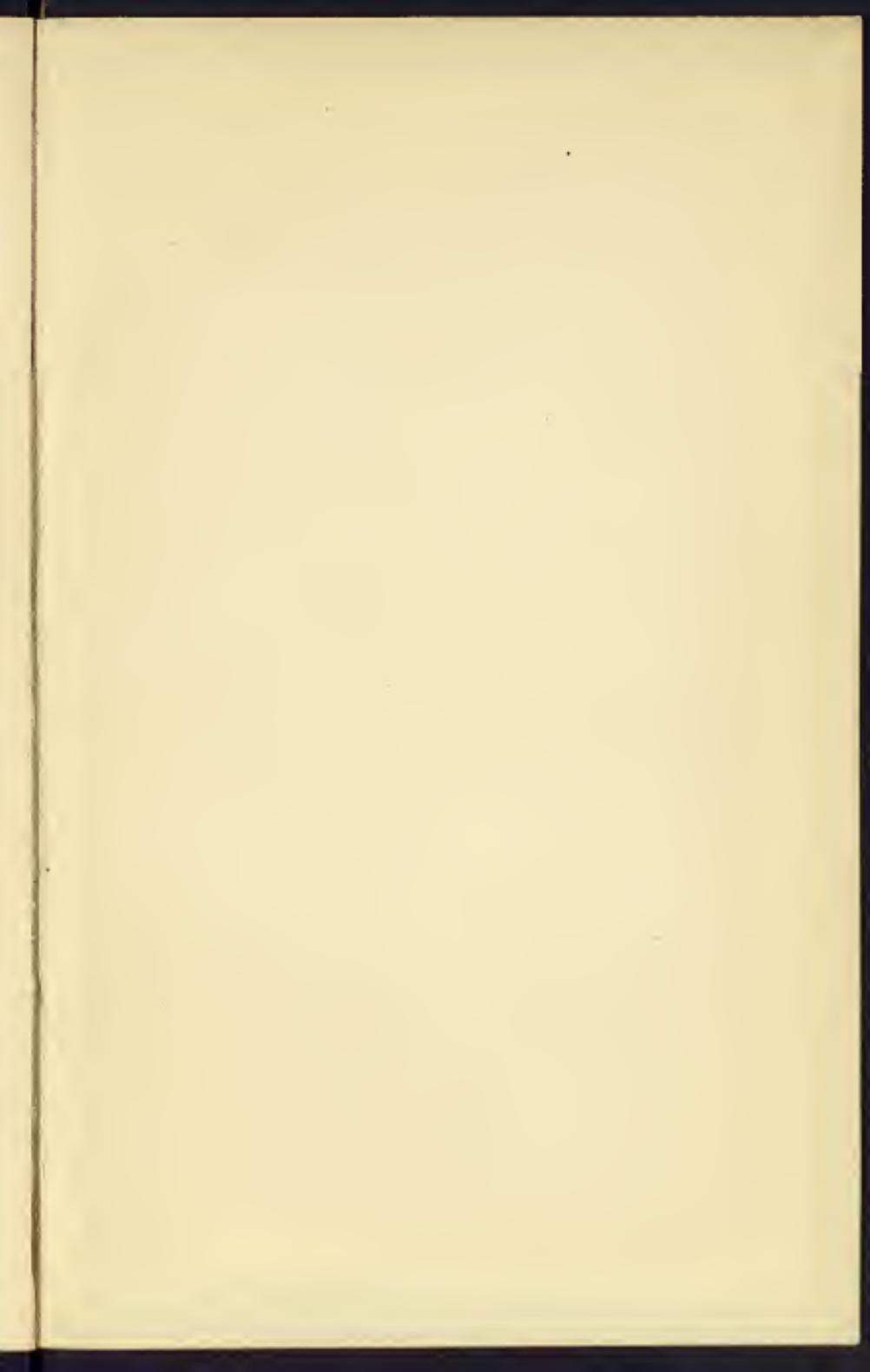
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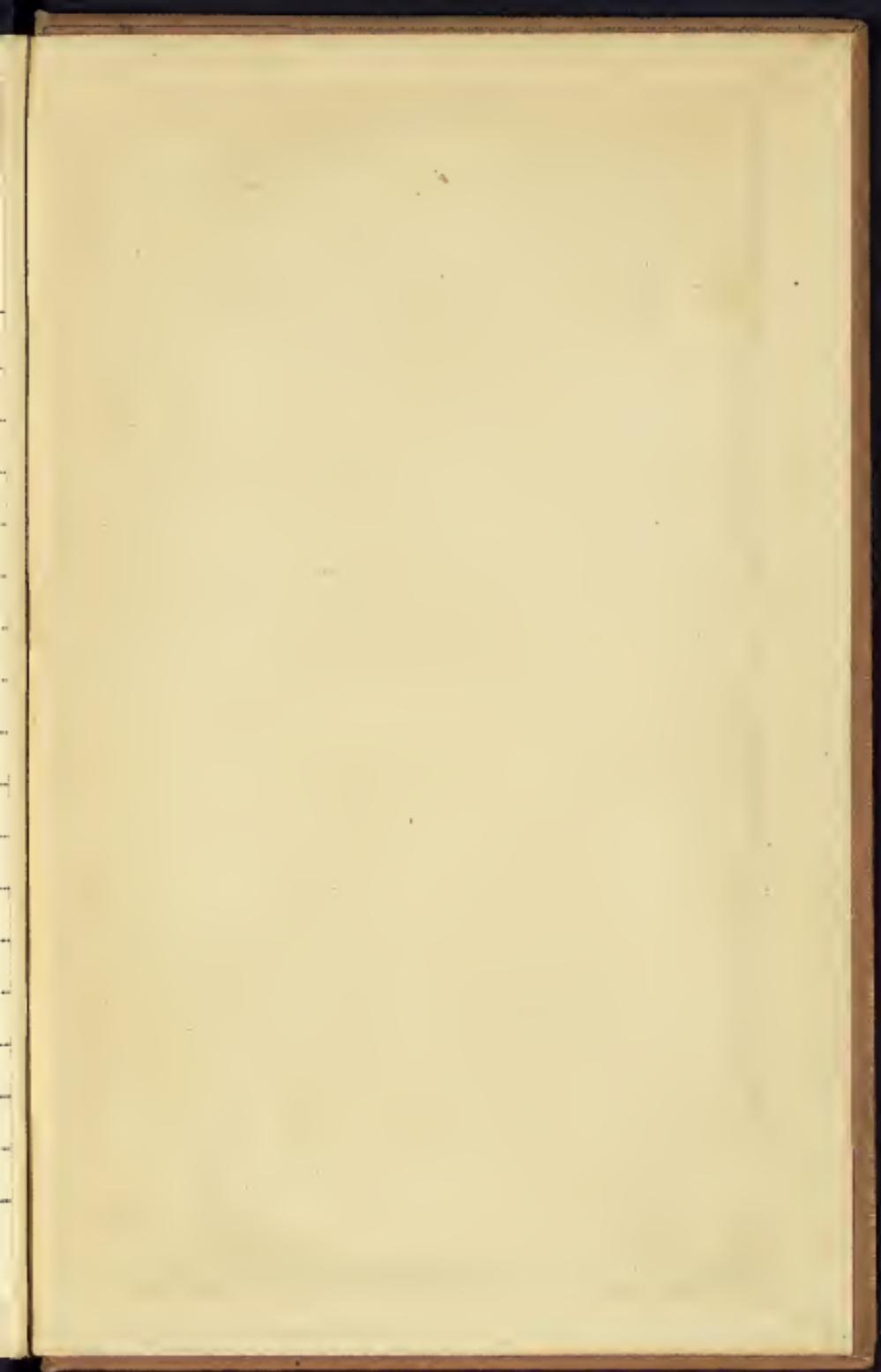




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